

Broadcasting Towers Operation

WEEK 1 – Tools identification and
selection

University: Rwanda Polytechnic – Tumba College

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General information of the course

- The course “Broadcasting Towers Operation” is taught in semester two to students of Level Six Year Two.
 - The course has 8 credits of 80 teaching hours including sessions’ delivery, in course assessments as well final exam.
 - The study visits shall be conducted to various towers to experience their operation.
 - Some learning to be in place (pre-requisites) are to be revised to grasp the concept that shall be used for better course delivery.
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Purpose statement

- This module describes the skills and knowledge required to monitor the broadcasting tower equipment, electrical equipment and air conditioner working principle and monitoring the adequate temperature.
 - At the end of this module; trainees will be able to monitor the broadcasting tower equipment, monitor the required power at broadcasting tower, place and monitor the adequate temperature.
 - Before taking this module, trainees should revise the Fundamentals of Telecommunication and the Fundamentals of Electronics.
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Elements of competence or learning units

The following are the learning units to be covered to ensure that a trainee is competent:

1. Monitor broadcasting tower equipment performance.
 2. Monitor Electrical equipment.
 3. Monitor Air conditioning performance.
 4. Report the work.
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Performance criteria or learning outcomes

Each of the learning units is associated with learning outcomes which will be based on, while assessing if a trainee is competent to perform the tasks related to the learning unit:

Monitor broadcasting tower equipment performance

- Proper selection of tools and equipment based on their types.
 - Periodic physical inspection of Transmitters, Receivers, Power Amplifiers and Audio Processors.
 - Proper analysis of Transmitter parameters according to the requirements.
 - Proper analysis of Receiver parameters according to the requirements.
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Performance criteria or learning outcomes cont'd

Monitor Electrical equipment

- Proper selection of tools and equipment based on their types.
- Periodic physical inspection of generator/UPS/AVR/ATS.
- Appropriate manual switching from main grid to Generator if ATS fails.

Monitor Air conditioning performance

- Proper description AC working principle.
 - Periodic physical inspection of AC.
 - Proper monitoring of AC temperature based on requirements.
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Performance criteria or learning outcomes cont'd

Report the work

- Proper report according to the equipment status.
- Document the recording challenges according to the work done.
- Hand over to next shift operator according to the work done.

Note: The course is will be taught in 12 weeks and one final exam will be set.

Turn and talk

Tools identification and selection

- In pair discuss the tools used in broadcasting towers operation.
 - Think of the selection of the electrical tools as well as electronics tools.
 - After you are introduced with the objectives of this week' or today's topic, you will share what you discussed.
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Objectives

At the end of the topic students will be able to:

1. Background
 2. Define and list out Electrical and electronics tools used in maintenance and monitoring.
 3. Explain the uses of tools for broadcasting towers operation.
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Rationale

- In the operation of broadcasting towers, the identification and selection of tools are crucial for ensuring efficiency and safety. Electronic toolkits typically include components essential for signal transmission, reception and maintenance.
 - Electrical tools are vital for maintaining integrity and protecting equipment and ensuring safe electrical connections because they work with components such as power supplies, grounding equipment, cabling, connectors among others.
 - When selecting these tools, considerations such as reliability, compatibility, safety, and cost-effectiveness are paramount.
 - Discussing these aspects in pairs enhances understanding and ensure proper identification and selection of tools required for broadcasting towers operation.
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1.1 Background

- Measurements are the basic means of acquiring knowledge about the parameters and variables involved in the operation of a physical system. Measurement generally involves using an instrument as a physical means of determining a quantity or variable.
 - A measuring instrument is defined as a device for determining the value or magnitude of a quantity or variable. Electrical and electronics instruments are based principles for their measurement function.
 - These days several measuring instruments are available in analog and digital nature to determine quantities like voltage, current, power energy, frequency, power factor and others.
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1.1 Background cont'd

- Measurement can be done using direct or indirect method.
 - Direct Measurement ensures unknown quantity measured directly such as measurement of current by an ammeter, voltage by voltmeter, resistance by ohm meter, power by wattmeter etc.
 - Indirect Measurement works with the fact that unknown quantity being determined by measuring other functionally related quantities and calculating the desired quantity rather than measuring it directly with an instrument.
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1.1 Background cont'd

- To measure the resistance of a conductor indirectly involves measuring voltage across the conductor V , and current flowing through the conductor I , and then calculating it by $R=V/I$, following the Ohm's Law.
 - Accuracy: closeness to the expected or desired value.
 - Precision: consistency of reproducibility or repeatability of output values.
 - Sensitivity: change in the output or response of the instrument for a unit change of input or measured variable.
 - Resolution: smallest change in a measured variable in output response.
 - Measuring instruments can be mechanical, electrical and electronics.
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1.1 Background cont'd

- Beside the instruments introduced in the previous slides, the tools used in broadcasting towers have various functions and some may act being both tools and equipment at the same time.
 - The tools that re described in the following slides are those involved in maintenance of electrical and electronics devices and equipment.
 - The field activities related to broadcasting towers require an operator to take some of these tools depending on the activities to carry out.
 - Electronics toolkit or toolbox contains several tools that are used for electronics related activities while electrical toolkit or toolbox contains several tools that are used for electrical related activities or both.
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1.2 Electrical and Electronics tools

- **Cable Cutters:** used to cut through cables and wires without squashing or fraying the ends.
- Identification: look for scissor-like tools with thick, sharp blades and insulated handles.
- Selection: choose based on the cable size and material (copper, aluminium) you need to cut.
- **Cutters** are hand tools to cut a variety of materials. An average pair has two levers fixed together by a fulcrum, which is located closer to one end.
- The shorter part is the jaws, and the longer section comprises the handles.
- They use levers to extend and increase the strength of grip. Pressing handles, holding power is magnified and directed to the point where the pincers meet.

(<https://uk.rs-online.com/web/content/discovery/ideas-and-advice/cutters-guide>)

1.2 Electrical and Electronics tools

- They are useful for a variety of applications, as they can be used with materials which are potentially too small to be worked by hand.
- There is a wide selection of different types available. They can come in various sizes and feature a range of pincers and joints, with the three basic types being locking, adjustable, and non-adjustable. These tools are typically made from steel.



Side Cutters



Cable Cutters



Flush Cutters



End Cutters



Diagonal Cutters

<https://uk.rs-online.com/web/content/discovery/ideas-and-advice/cutters-guide>

1.2 Electrical and Electronics tools

- **Hexa-blade:** typically refers to a saw blade with hexagonal edges, used for cutting various materials.
 - Identification: look for a saw blade with hexagonal teeth.
 - Selection: choose based on the material you need to cut and the compatibility with your saw.
 - There are many different types of handsaws available, each designed with a particular material or cutting surface in mind.
 - The most important factor to choose a handsaw is the intended application.
 - A hand saw is a manually operated cutting tool, designed to help you make incisions into different surface types as well as trimming materials to size.
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1.2 Electrical and Electronics tools



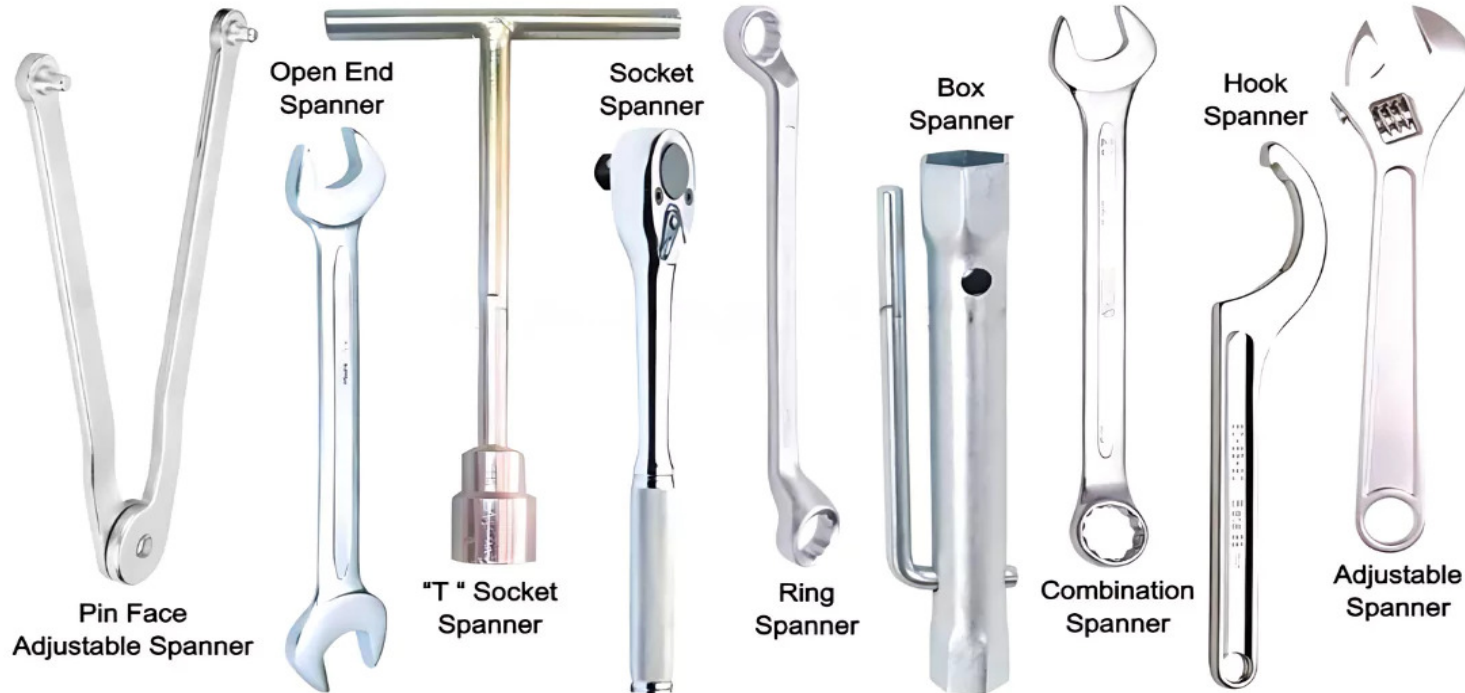
[\(https://www.redboxtools.com/news/buying-guide-handsaw-types/\)](https://www.redboxtools.com/news/buying-guide-handsaw-types/)

1.2 Electrical and Electronics tools cont'd

- **Spanner:** used to provide grip and mechanical advantage in applying torque to turn objects like nuts and bolts.
 - Identification: look for open-ended or ring-shaped tools designed to fit specific sizes of fasteners.
 - Selection: choose based on the size and type of fasteners needed to work with.
 - Higher-quality spanners are typically made from chromium-vanadium alloy tool steels and are often drop-forged. They are frequently chrome-plated to resist corrosion and for ease of cleaning.
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1.2 Electrical and Electronics tools cont'd

10 Different Types of Spanners



[\(https://www.mechdaily.com/types-of-spanners/\)](https://www.mechdaily.com/types-of-spanners/)

1.2 Electrical and Electronics tools cont'd

- **Screwdrivers:** used for inserting and removing screws.
- Identification: look for tools with a handle and a metal shaft ending in a tip fitting into the screw head (flathead, Phillips).
- Selection: choose based on the type of screws needed to work with (flathead, Phillips, Torx)



[\(https://www.redboxtools.com/news/screwdriver-types-uses/\)](https://www.redboxtools.com/news/screwdriver-types-uses/)

1.2 Electrical and Electronics tools cont'd

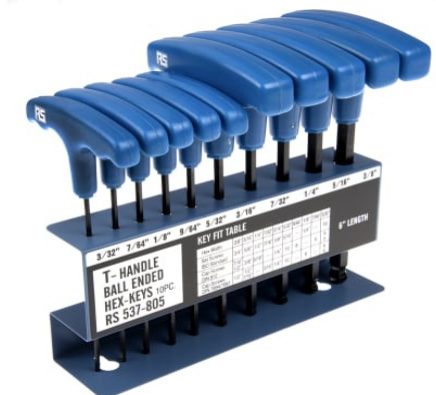
- **Cable Crimpers:** used to conjoin two pieces of metal by deforming one or both to hold them together securely.
- Identification: resemble pliers but have special notches at the jaws for crimping.
- Selection: choose based on the type and size of connectors and cables needed to crimp.



(<https://www.powerandcables.com/product/product-category/klauke-ek50ml/>)

1.2 Electrical and Electronics tools cont'd

- **Allen Keys:** used to drive bolts and screws with hexagonal sockets.
- Identification: L-shaped tools with hexagonal ends.
- Selection: choose a set with various sizes to match the hexagonal sockets you need to work with.
- The figures show keys set, T- handle and ball end Hex keys.



<https://uk.rs-online.com/web/content/discovery/ideas-and-advice/hex-keys-guide>

1.2 Electrical and Electronics tools cont'd

- **Pliers:** used for gripping, bending, and cutting materials like wire.
 - Identification: look for tools with two metal levers joined at a fulcrum, creating short jaws on one side.
 - Selection: choose based on the specific task (needle-nose for precision, linesmen for heavy-duty work).
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1.2 Electrical and Electronics tools cont'd



[\(https://www.redboxtools.com/news/types-of-pliers/\)](https://www.redboxtools.com/news/types-of-pliers/)

1.2 Electrical and Electronics tools cont'd

- **Hammer:** used for driving nails, breaking objects, and other tasks requiring impact force.
- Identification: look for a tool with a heavy head attached to a long handle
- Selection: choose based on the weight and type of head (claw hammer for nails, sledgehammer for demolition).



[\(https://www.redboxtools.com/news/types-of-hammers-and-uses/\)](https://www.redboxtools.com/news/types-of-hammers-and-uses/)

1.2 Electrical and Electronics tools cont'd

- **Stripping Pliers:** designed for stripping insulation from electrical wires without damaging the wire.
 - Identification: similar to regular pliers but with notches for stripping insulation.
 - Selection: choose based on the wire sizes you need to strip.
 - **Saw:** used for cutting through materials like wood, metal, or plastic.
 - Identification: look for a tool with a toothed blade and a handle.
 - Selection: choose based on the material you need to cut and the type of saw (hack saw for metal, handsaw for wood).
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1.2 Electrical and Electronics tools cont'd

- **Tester:** used to test electrical circuits and components.
- Identification: look for a device with probes and a display or indicator.
- Selection: choose based on the type of testing you need to perform (voltage tester, continuity tester).
- The figure shown are for network cable tester.



<https://www.fiber-optic-components.com/brief-introduction-network-cable-tester.html>

<https://www.walmart.ca/en/ip/Cable-Tester-Network-Testing-Tool-RJ4511-5E-6-Network-Tester/PRD2TBFSCCT97R5>

1.2 Electrical and Electronics tools cont'd

- **Thermometer:** used to measure temperature.
- Identification: look for a device with a temperature sensor and a display.
- Selection: choose based on the temperature range and accuracy required for your application

Thermometer Types: Digital, Infrared, Glass, Bimetallic, and Mercury used to measure temperature in various settings like medical, industrial, culinary fields, etc.



[dreamstime.com](https://www.dreamstime.com)

ID 272476296 © Dreamstime.com

(Set Thermometer Types, Digital, Infrared, Glass, Bimetallic, and Mercury Used To Measure Temperature in Various Settings, Dreamstime, 2024.)

1.2 Electrical and Electronics tools cont'd

- **Multimeter:** measures voltage, current, and resistance.
- Function: essential for diagnosing and troubleshooting electrical circuits.
- **Wire Strippers:** removes insulation from electrical wires.
- Function: prepares wires for connections or soldering
- **Insulated Screwdrivers:** tightens or loosens screws in electrical components.
- Function: provides safety by preventing electrical shocks



(<https://en.wikipedia.org/wiki/Multimeter>)

1.2 Electrical and Electronics tools cont'd

- **Voltage Tester:** checks for the presence of voltage in electrical circuits.
- **Function:** ensures safety by confirming circuits are de-energized before work.



Quickly test for presence of voltage, how much, as well as what current a wire is carrying.

<https://www.fluke.com/en-us/products/electrical-testing/basic-testers>

1.2 Electrical and Electronics tools cont'd

- **Fish Tape:** pulls wire through conduit.
- Function: facilitates the installation of wiring in walls and ceilings
- **Electrical Tape:** insulates electrical wires and other materials.
- Function: provides protection and prevents short circuits
- **Conduit Bender:** bends conduit pipes to desired angles.
- Function: helps in routing electrical wiring through buildings.
- **Circuit Tester:** tests the functionality of electrical circuits.
- Function: identifies faults and ensures circuits are working correctly.
- All images are taken from the list materials to purchase.



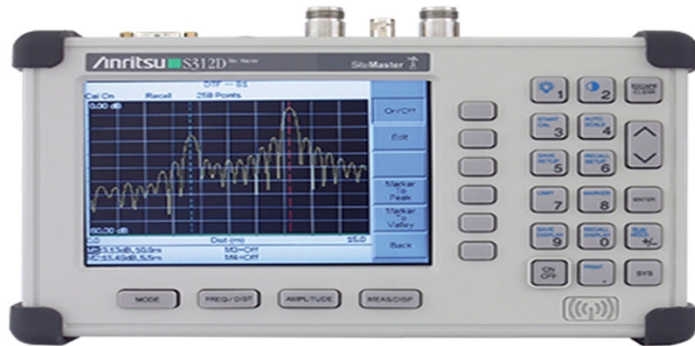
1.2 Electrical and Electronics tools cont'd

- **Clamp meter:** convenient in situations where multimeters fail by detect the magnetic field emitted by current flowing in a wire in order to measure the current value (<https://www.hioki.com/global/learning/how-to/u-clamp-meters.html>)
- **Soldering iron:** A soldering iron is composed of a heated metal tip (the bit) and an insulated handle. Heating is often achieved electrically, by passing an electric current (supplied through an electrical cord or battery cables) through a resistive heating element



1.2 Electrical and Electronics tools cont'd

- **Phase tester:** used on grounded and ungrounded alternating current systems to check high-voltage fuses, test for correct phase connections and test for the absence of high voltage on de-energized lines or apparatus.
- **The Site Master:** designed for measuring SWR, return loss, or one-port cable insertion loss and fault locations of RF components in antenna systems.



(<https://www.amprobe.com/product/prm-6/>)

(https://www.tehencom.com/Products/ElectronicEquipment/Categories/MobileNetworks/Anritsu_S332D-e.htm)

1.3 Uses of tools for broadcasting towers

- Broadcasting tower operators in cellular systems rely on a variety of electrical and electronic tools to ensure seamless communication and network performance.
 - Many of the discussed tools are always essential for field operation. Some tools are also utilized to test and calibrate the broadcasting equipment, ensuring that the signals are transmitted at the correct frequencies and power levels.
 - These tools are essential for the initial setup and ongoing maintenance of broadcasting towers.
 - **Power meters** are also commonly used to measure the power output of the broadcasting equipment, ensuring that it operates within the specified limits. These tools help in preventing any damage to the equipment and maintaining the overall efficiency of the broadcasting system.
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1.3 Uses of tools for broadcasting towers

- **Clamp meters** and **multimeters** are indispensable for electrical testing and troubleshooting.
 - Clamp meters allow operators to measure the current flowing through the cables without disconnecting them, making it easier to identify any issues in the power supply.
 - Multimeters, on the other hand, are used to measure voltage, current, and resistance, providing a comprehensive overview of the electrical parameters. These tools are essential for diagnosing and fixing any electrical problems that may arise in the broadcasting towers.
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Thank you for your good attention
Q&A

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