9

TLE – Industrial Arts:

Electrical Installation and Maintenance

Quarter 1 – Module 4

Electrical Materials

(Week 4)

DepED
DEPARTMENT OF EDUCATION

What I Need to Know

This module contains information and suggested learning activities on the preparation of electric materials and tools. It includes instructions and procedures on how to select and prepare materials needed in electrical wiring installation and in storing unused and surplus electrical materials upon completion of the job.

After going through this module, you are expected to:

1. identify electrical materials used for electrical installation,
2. describe the characteristics and features of each of the electrical material, and
3. appreciate the value of using good quality materials in electrical installation and maintenance.

What I Know

Please do not forget to write the following in your answer sheet:
Name: _____ Yr. & Section: _____
Yr. Level & Subject (Specialization): _____ Module No: _____
Name of the Activity (e.g., What I know) _____ Date: _____

Multiple Choice

Directions: Read each statement carefully. Write the letter of your correct answer in your answer sheet.

1. It is a single, usually cylindrical, flexible strand or rod of metal.
   A. cable B. junction box C. utility box D. wire
2. These are electrical protective devices which are used to interrupt the flow of current when short circuit or overcurrent occurs.
   A. breakers and fuses B. electrical tapes C. wires D. wires and cables
3. These are made of steel and nonmetallic materials(plastic), used in housing electrical wiring connections and installing switches and outlets.
   A. electrical boxes C. electrical raceways
   B. electrical outlets D. electrical switches
4. It is an electrical device which is used to turn **ON** and **OFF** the circuit.
   A. fuse B. outlet C. switch D. wire
5. These are some electrical materials which are commonly used to fit wiring devices during wiring installation.
   A. breakers and fuses C. electrical fittings and accessories
   B. electrical boxes D. electrical switches
6. These boxes are used for convenience outlets, switch boxes or small junction boxes.
   A. Junction box B. Panel Box C. Safety Switch box D. Utility Box

7. A box where the circuit breaker is installed.
   A. Circuit Breaker Box B. Panel Box C. Safety Switch Box D. Square Box
8. A type of switch mounted in a flush wall box so that only its front face is visible.
   A. Flush Type Switch C. Three-way Switch
   B. Surface Type Switch D. Tumbler Switch
9. A snap switch designed for mounting on a plane surface and requiring no enclosing parts (such as a box).
   A. Flush Type Switch C. Three-way Switch
   B. Surface Type Switch D. Tumbler Switch
10. A fitting resembling a pipe or box with a removable cover for access to electric conduits —formerly a U.S. registered trademark.
   A. Condulets C. Insulated Staple Nail
   B. Electrical Tape D. Porcelain Tubing

What's In

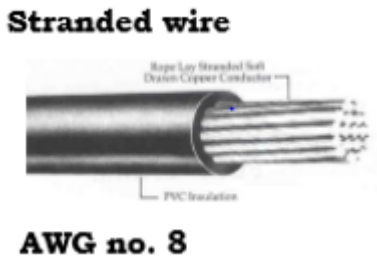
Electrical Material is basically the parts or elements used in the making of any electrical construction project. This can vary from a small house circuit to as big as a large industrial plant.

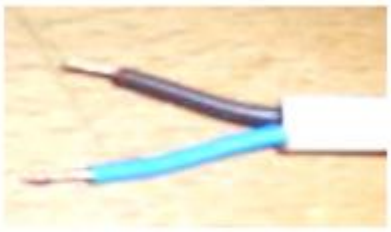
What's New

Electrical Materials

A. Wires and Cables

A **Wire** is a single, usually cylindrical, flexible strand or rod of metal.





1. **Stranded Wire.** A stranded wire is composed of numerous thinner wires twisted together into a cohesive bunch. It serves a better purpose in intricate usages, such as electronic devices and circuit boards, where the wire will be protected but may undergo bending or twisting in order to connect electronic components.
2. **Solid Wire.** Consists of a single metal core, suited for outdoor or rugged-duty applications which may expose the wire to corrosive elements, adverse weather conditions or frequent movement.

Cables are composed of two or more electric conductors insulated from one another. They are larger than wires.

Cables

Types of Wire and Cable Insulation

Insulations	Letter Type
Weather Proof	WP
Slow Burning	SB
Slow Burning Weatherproof	SBW
Rubber – Code Compound	R
Heat Resistant	RH
Moisture Resistant	RW
Moisture and Heat Resistant	RH – RW
Latex (Regular)	RU
Latex (Moisture Resistant)	RU
Mineral (Metal – Sheathed)	MI
Thermoplastic Compound	
Thermoplastic	T
Moisture – Resistant Thermoplastic	TW
Moisture and Heat Resistant Thermoplastic	THW
Thermoplastic and Fibrous Outer Braid	TBS
Thermoplastic and Asbestos	T
Varnish Cambric	
Standard Black	V
Paper	
Solid Type	
Oil – Filled	
Untreated	
Treated	
Asbestos	
Non – impregnated	A and AA
Impregnated	AI and AIA
Asbestos – Varnished – Cambric	
Outer Asbestos Braid	AVA

Lead Covered	
Cotton Braid Covered	AVB
Silicon Asbestos	SA

B. Electrical Boxes

Electrical boxes are made of steel and nonmetallic materials(plastic). Metal boxes are made of #14 heavy galvanized steel and available in four principal shapes: square, octagon, rectangular, and circular.

Utility Box

Octagonal Box

Square Box

Circuit Breaker Box

Panel Box

Safety Switch Box

1. **Utility Box.** Utility boxes are used for convenience outlets, switch boxes or small junction boxes.
2. **Octagonal Box.** It is a common type of box that is typically used for installing light fixtures on a wall or ceiling. It is also used in housing electrical joints or connections.
3. **Square Box.** Square boxes come in standard depths of 1 1/4 to 2 1/8 inches, but their square corners give them additional interior space, providing maximum volume for multiple conductors and connectors. For this reason, 4-inch square boxes often are used to run multiple conductors in two or more directions. They are also commonly used as junction boxes and can also be installed in ceilings or walls for supporting lighting fixtures or for housing switches or receptacles when matched with the proper cover plates.
4. **Circuit Breaker Box.** It is where the circuit breaker is installed.
5. **Panel Box.** It is the main distribution point for electrical circuits in your home. It usually provides between 100 and 200 amps of power, depending on the rating of the panel. It is where your individual breakers are located.

6. **Safety Switch Box**. It is a metal box containing the electrical safety switch with an external control handle and so designed that the box cannot be opened while the switch is closed, and the switch cannot be closed while the box is open.

C. Fuses and circuit breakers

Fuses and circuit breakers are electrical protective devices which are used to interrupt the flow of current when short circuit or overcurrent occurs. They are available in different sizes and shapes and ratings. The common types are:

Cartridge fuse

Knife blade fuse

Plug Fuse

Molded-case Circuit breaker (3 – Pole type shown

1. Fuse. Fuse is a current interrupting device which protects an electrical circuit in which it is installed by creating an open circuit condition in response to excessive current.

2. Circuit Breaker. A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected.

D. Switch

It is an electrical device which is used to turn **ON** and **OFF** the circuit.

Flush type

Tumbler type

Surface Type

1. **Flush Type Switch.** A type of switch mounted in a flush wall box so that only its front face is visible.
2. **Tumbler Switch.** A snap switch in which the blades are actuated by a lever being pushed up or pulled down.
3. **Surface Type Switch.** A snap switch designed for mounting on a plane surface and requiring no enclosing parts (such as a box).

E. Fittings and accessories

These are some electrical materials which are commonly used to fit wiring devices during wiring installation. The following are some examples of these materials:

Insulated Staple Nail

Condulets

Porcelain tubing

Electrical tape

Sand paper

PVC fittings

Metal clamp

Double Clamp

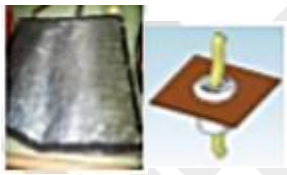
Male Plugs

Connectors

Coupling

Liquid Tight Connector

Lock Nut and Bushing



Wire Bushing

Wire Connector

1. **Insulated Staple Nail.** These are fasteners for securing electrical cable and wires. These metal staples are coated in PVC to help prevent arc faults in electrical applications.
2. **Condulets.** A fitting resembling a pipe or box with a removable cover for access to electric conduits —formerly a U.S. registered trademark.
3. **Porcelain Tubing**. A ceramic tube having a slight shoulder on one end; in exposed electrical wiring, used to carry an insulated conductor where it passes through a wood joist, stud, etc.
4. **Electrical Tape.** A poorly conductive plastic tape used to insulate electrical wires.
5. **Sandpaper**. A type of coated abrasive that consists of sheets of paper or cloth with abrasive material glued to one face. This is usually used to smoothen the surface of a PVC or EMT tubing.
6. **PVC Fittings**. Fittings used to secure PVC pipes and plastic boxes during wiring installations.
7. **Metal Clamp.** A fitting used to secure the metallic tubing in place during wiring installation.
8. **Double Clamp/Metal Strap.** The same as metal clamp, this is used to secure the EMT in place during installation.

9. **Male Plugs.** The connecting end of the cord on an electrical device, having two or three pins, is inserted into a matching socket to make an electrical connection.
10. **Connectors.** A device that joins electrical raceways to the electrical boxes.
11. **Coupling.** A coupling is of two types: metallic and plastic coupling. The first one is used for connecting two threaded metallic tubing and the other one is for plastic corrugated pipe (PCP).
12. **Liquid Tight Connector.** The liquid-tight connector, also named liquid tight conduit fittings (or seal tight connector), was usually installed with the flexible conduit as the seal tight fittings to ensure the waterproof degree.
13. **Locknut and Bushing**. A locknut is used to secure an ordinary nut from working loose by locking itself when screwed down tight. A bushing I used with lock nuts to terminate RSC on IMC conduit to the enclosure/box.
14. **Wire Connector**. Wire connectors are used to connect two or more wires together. There are many types of wire connectors, the most common are twist-on. Twist-on wire connectors are available in many different color-coded sizes to allow for different wire gauges and number of wires.

Anchor and fastening devices are as follows:

a. Screw
b. Bolts
c. Screw anchor (tox)
d. Expansion bolt
e. Spring wing toggle bolt

What's More

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Directions: On a short bond paper, illustrate the following electrical materials:

1. Fuse
2. Utility box
3. Switch
4. Cable
5. Insulated staple

What I Have Learned

Please do not forget to write the following in your answer sheet:
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1. The two types of wires are:

_____ _____

2. The following are examples of electrical boxes:

_____ _____
_____ _____

_____ _____

3. List down at least five (5) examples of electrical fittings and accessories.

_____ _____

_____ _____

Assessment

Please do not forget to write the following in your answer sheet:
Name: _____ Yr. & Section: _____
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Name of the Activity (e.g., What I know) _____ Date: _____

A. Directions: Select the best answer. Write the letter of the correct answer in your answer sheet.

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C. electrical raceways
D. electrical switches

9. It is an electrical device which is used to turn **ON** and **OFF** the circuit.
A. fuse B. outlet C. switch D. wire

10. These are some electrical materials which are commonly used to fit wiring devices during wiring installation.
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B. electrical boxes
C. electrical fittings and accessories
D. electrical switches

Answer Key

What I Have Learned

1. Solid Wire
Stranded Wire
2. Utility Box
Octagonal Box
Square Box
Circuit Breaker Box
Panel Box
Switch Box
3. Insulated Staple nail
Conduiets
Porcelain Tubing
Tape
Connectors

Reference

Department of Education Learner's Material, first edition 2014