

# 10

## **TVL Industrial Arts: Electrical Installation and Maintenance (EIM) NCII**

**Quarter 2 – Module 1:  
“PEC Provision in Installing  
Electrical Boxes”  
(Week 1)**



## ***What I Need to Know***

This module contains information and suggested learning activities in the installation of wiring devices for floor and ground fault current interrupting outlets. It includes instructions and procedures on how to select and install electrical boxes and other wiring devices.

This module consists of learning outcomes which will be achieved through the learning activities supported by instruction sheets. Before you perform the instructions, read the information sheets, and answer the self-activities provided to assess yourself and for your teacher to determine that you have acquired the knowledge necessary to perform the skill required in each particular learning outcome.

You are required to go through a series of learning activities to complete each of the learning outcomes of the module.

At the end of this module, you should be able to:

1. determine the different types of electrical boxes and their uses;
2. interpret plan or drawing based on the given requirements; and
3. illustrate the electrical boxes in accordance with the PEC.

This module covers the Introduction/ Learning Objectives, Pre-Assessment, Lesson Proper, Generalization, Application, Post Assessment, Additional Activity (optional).



## ***What I Know***

Name: \_\_\_\_\_ Grade and Section: \_\_\_\_\_ Quarter: \_\_\_\_  
Module Number: \_\_\_\_\_ Lesson Title: \_\_\_\_\_

**A. Multiple Choice.** Choose the letter of your answer and write it on a separate sheet of paper.

1. It is made of metal or plastic and has the capability to be mounted on a wall or stud.  
A. Wall box                      B. Drywall box    C. Handy box    D. Weatherproof box
2. It is used for exterior switches or receptacles.  
A. Wall box                      B. Drywall box    C. Handy box    D. Weatherproof box
3. It is also known as faceplates or covers.  
A. Plastic box    B. Wall plates              C. Ceiling box              D. Drywall box
4. It is also known as a junction box or splice box.  
A. Plastic box    B. Wall plates              C. Ceiling box              D. Drywall box
5. It is a metal box, usually 2" wide, 3" high and 2 1/2" deep.

- A. Gem box      B. Wall box      C. Ceiling box      D. Plastic box
6. It is best for new installation and often has a nail built-in for quick attachment to the stud.
- A. Plastic box      B. Wall plates      C. Ceiling box      D. Drywall box
7. It has expandable arms and can be mounted on drywall.
- A. Wall box      B. Drywall box      C. Handy box      D. Weatherproof box
8. It is a surface mounted box and has rounded corners for safety.
- A. Wall box      B. Drywall box      C. Handy box      D. Weatherproof box
9. It is the size required by the code in mounting boxes behind the surface of non-combustible materials.
- A. 1/4-inch      B. 1/2-inch      C. 3/4-inch      D. 1 inch
10. It is the easiest method in mounting boxes.
- A. Plastic box      B. Wall plates      C. By nails      D. Drywall box
11. The primary function of the electrical box.
- A. Maybe required by the PEC
- B. To house electrical connections
- C. To have a good design
- D. It is the suggestion of the owner of the building
12. It is one of the characteristics of weatherproof boxes.
- A. They are not used as an outdoor box.
- B. Used for exterior switches or receptacles not advisable.
- C. They are thicker than interior boxes and has a rubber gasket between the cover and the box to keep out water.
- D. The boxes are exposed without any cover.
13. How many maximum numbers of wire in a 4x2 $\frac{1}{8}$ x1 $\frac{7}{8}$  inches utility type of box?
- A. 4      B. 5      C. 6      D. 7

For questions number 14 and 15.

Robert installed electrical boxes located outside from his house and Elvis used junction box to anchor ceiling fixtures.

14. What type of electrical box that Robert used?
- A. Ceiling box      C. Wall boxes
- B. Metal box      D. Weather-proof boxes
15. Type of electrical box that Elvis installed.
- A. Ceiling boxes      C. Wall boxes
- B. Metal boxes      D. Weather-proof boxes



## What is It

### PEC PROVISION IN INSTALLING ELECTRICAL BOXES

The primary function of the electrical box is to house electrical connections. These connections might be to a switch, a receptacle, the leads of a light fixture, or other sets of wire.

The Philippine Electrical Codes require that all wire connections or cable splices must be inside an approved metal or plastic box, and every box must be accessible and not buried inside a wall. This protects your home from the danger of fire and makes it easier to inspect and upgrade your wiring in the future.

The Codes govern how many connections you can make within a box. If you must make more connections, you must use a larger box. Boxes for switches and receptacles serve as workhorses in any electrical installation. Some of the metal ones can be ganged into double, triple, or larger multiples by removing one side and linking them together.

#### Allowable Number of Wires Allowed in a Box

Type of box	Size in inches (LxWxH)	Maximum number of wires allowed in a box		
		AWG # 14	AWG #12	AWG #10
Switch	3x2x1½	3	3	<b>3</b>
Receptacle	3x2x2	5	4	<b>4</b>
	3x2x2¼	5	4	<b>4</b>
	3x2x2½	6	5	<b>5</b>
	3x2x2¾	7	6	<b>5</b>
	3x2x3½	9	8	<b>7</b>
Utility	4x2½x1½	5	4	<b>4</b>
	4x2½x1⅞	6	5	<b>5</b>
	4x2½x2⅞	7	6	<b>5</b>
Fixture Junction	4x4x1¼ (Round or octagonal)	6	5	<b>5</b>
	4x4x2⅞	10	9	<b>8</b>



Boxes should be installed so that the outside edges are flushed with the finishing material. You know the materials you will be using, but make sure that you know the thickness of any panel, wallboard, or combinations. (For 3/8-inch drywall plus 1/4-inch paneling, for example the box should stick out 5/8-inch from the front of the framing.) The code allows boxes to be as deep as 1/2 inch behind the surface of noncombustible materials, such as gypsum wallboard, brick, or concrete block. This may cause some problems, but you may line up the receptacle and cover plate.

### **Mounting Boxes**

There are many different types of electrical boxes, but basically there are only two ways of attaching them to walls and ceilings. The easiest method, used almost universally in new construction, is to nail the box directly to the framing of the work before any finishing materials are attached to walls or ceilings. The most convenient boxes are equipped with mounting brackets welded to the box itself. Simply nail through the bracket into the front or sides of the studs or joist bottoms with 1-inch roofing nails. Other boxes are nailed with 8d (8-penny) nails into the sides of the studs through projections on the top or bottom, or through holes pre-drilled in the boxes themselves. Some boxes, usually plastic ones, come with nails already attached through inline projections. Occasionally, a box must be located away from the framing members. This is often true for ceiling fixtures, and sometimes wall fixtures, when exact placement is more desirable than it is for a switch or outlet. For a new work, use wood cleats, metal mounting straps, or adjustable bar hangers, which are nailed into the studs or joists on each end. The box can then be slid and locked in place at the optimum location.

### **Old Work**

It is more difficult to work with existing walls or ceiling, box mounting, like everything else in old work. When the proper location of the box is determined, a hole is cut into the wallboard or paneling to accept the new box. Make a paper or cardboard template of the box by laying it face down and tracing around it. (Some box manufacturers supply a template with the box). Trace around the template onto the wall to mark the rough opening. If only one or two boxes are involved, you may simply hold the box itself to the wall. If the walls consist of gypsum wallboard or paneling, drill holes about 1/2 inch in diameter at the corners of the box opening and cut out the opening with a keyhole saw.

### **Special Mounting Devices**

For all other walls, special mounting devices will be needed. There are several types of mounting devices, many of which are attached to the boxes themselves. Some have clamp-like devices that hug the back of the wallboard when the attached screws are turned. Boxes without mounting devices can be attached to wall boards or thin paneling with "Madison clips," which are slipped between the box and the wall on both sides, then bent back over the insides of the boxes.

### **Installing Wiring in Wood Framing Receptacle and ceiling box installation.**

Choose boxes that are easy to install so that they will be flushed with the finished wall surface. The most common type of boxes used in the residential areas are the

non-metallic pre-nailed *Nail-on* types. Position the switch and receptacle boxes at uniform heights.

### Drilling holes in the studs

Drill holes at the center of the studs, so that the edges are not less than one and one-fourth ( $1\frac{1}{4}$ ) inches from the edge. If the hole is closer to the edge of the stud, or if you have to make a notch instead of a hole (where wiring must go through corner framing, for example), then the NM cable must be protected from nails by installing a protective metal plate.

### Types of Electrical Box

#### 1. Wall boxes

- They are used for housing switches and receptacles.
- They are made of metal or plastic and have the capability to be mounted to a wall or stud.
- The holes in the side of the box where the conduit enters the box are called knockouts. In metal boxes, the conduit can also be secured to the holes.
- One type is a four-inch square box that is only  $1\frac{1}{2}$ " or 2" deep used in places that are too shallow to mount a standard box.

**a. Handy boxes** are surface mounted with rounded corners for safety.



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**b. Drywall boxes** have expandable arms and can be mounted on a drywall.



[https://commons.wikimedia.org/wiki/File:ABB\\_junction\\_box\\_for\\_drywall.JPG](https://commons.wikimedia.org/wiki/File:ABB_junction_box_for_drywall.JPG)

**c. Plastic boxes** are best for new installation and often have a nail built-in for quick attachment to the stud.



<https://www.lowes.com/pl/Plastic--Electrical-boxes-Electrical-boxes-covers-Electrical/4294653959?refinement=4294965728>

- d. Gem boxes** are commonly made boxes, usually 2" wide, 3" high and 2 1/2" deep and made of metal. Deeper boxes are also available.



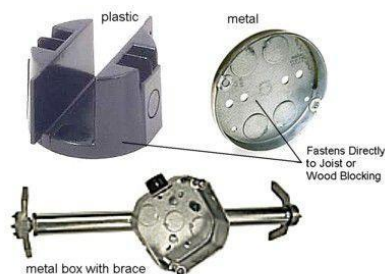
<https://www.greschlers.com/1-1-2-electrical-gem-box/>

2. **Weather-proof Boxes**

- They are also known as an outdoor box.
- They are used for exterior switches or receptacles.
- They are thicker than interior boxes and have a rubber gasket between the cover and the box to keep out water.
- Their covers are either screw-on or snap-on.

3. **Ceiling Boxes**

- They are also known as junction boxes or splice boxes.
- They are used to anchor ceiling fixtures and serve as a junction box where wires can meet and run into other areas of the room.
- They are either 4" octagonal or round shaped, and either 1-1/2" or 2-1/8" deep.
- They may also include adjustable mounting hangers that attach to the rafters in the ceiling and allow the box to be placed anywhere in between.



<https://www.thespruce.com/electrical-switch-and-junction-boxes-1824666>

4. **Wall Plates**

- They are known as faceplates or covers.

- They are flat metal, plastic, or wooden pieces that covers the openings in the wall made by receptacles and switches.
- Their openings in the cover match the type and number, or receptacles or switches being covered. Blank covers are also available.



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## What's More

Name: \_\_\_\_\_ Grade and Section: \_\_\_\_\_ Quarter: \_\_\_\_\_  
Module Number: \_\_\_\_\_ Lesson Title: \_\_\_\_\_

### Installing boxes in the finished space

Instruction: Given the line diagram below, draw the **Pictorial Diagram** in a long size bond paper following the scale as illustrated in the diagram.

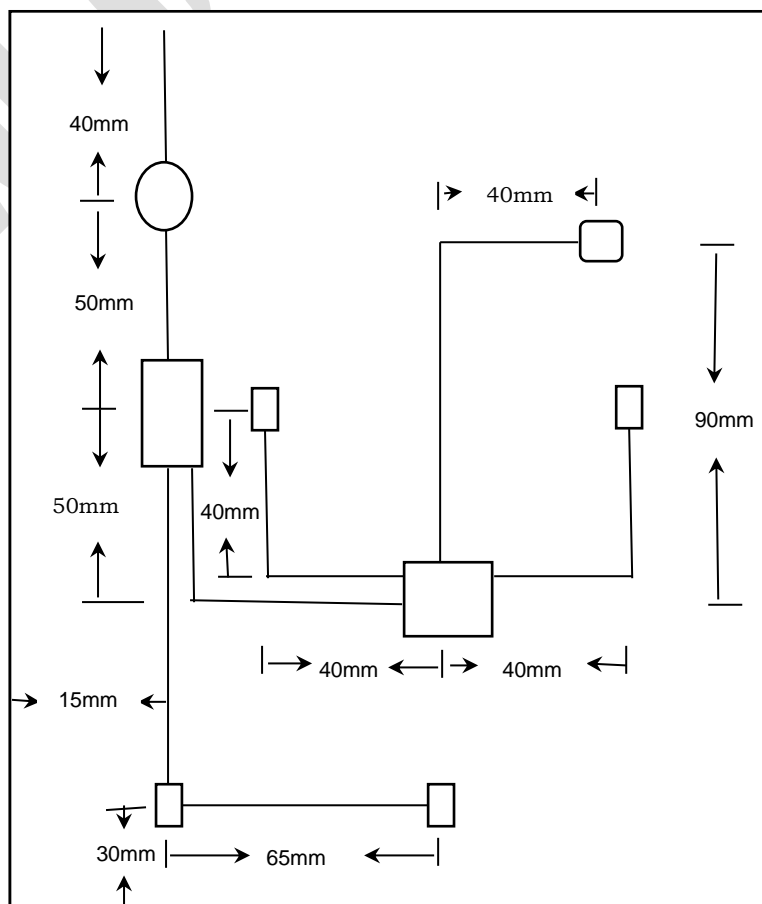


#### Supplies and materials

- Meter base (MB)
- Panel board
- Utility box
- Junction box
- Octagonal junction box

#### Tools

- Pencil
- Ruler







## Assessment

Name: \_\_\_\_\_ Grade and Section: \_\_\_\_\_ Quarter: \_\_\_\_  
Module Number: \_\_\_\_\_ Lesson Title: \_\_\_\_\_

**A. Multiple Choice.** Choose the letter of your answer and write it on a separate sheet of paper.

1. It is made of metal or plastic and has the capability to be mounted on a wall or stud.
  - A. Weatherproof box
  - B. Gem box
  - C. Wall box
  - D. Dry wall box
2. It is used for exterior switches or receptacles.
  - A. Weatherproof box
  - B. Gem box
  - C. Wall box
  - D. Dry wall box
3. It is also known as faceplates or covers.
  - A. Wall plates
  - B. Plastic box
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5. It is a metal box, usually 2" wide, 3" high and 2 1/2" deep.
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  - B. Gem box
  - C. Wall box
  - D. Dry wall box
6. It is best for new installation and often has a nail built-in for quick attachment to the stud.
  - A. Wall plates
  - B. Plastic box
  - C. Drywall box
  - D. Ceiling box
7. It has expandable arms and can be mounted on drywall.
  - A. Weatherproof box
  - B. Gem box
  - C. Wall box
  - D. Dry wall box
8. It is a surface mounted box and has rounded corners for safety.
  - A. Handy box
  - B. Plastic box
  - C. Drywall box
  - D. Ceiling box
9. It is the size required by the code in mounting boxes behind the surface of non-combustible materials.
  - A. 1/2 inch
  - B. 1/4 inch
  - C. 3/4 inch
  - D. 1/8 inch
10. It is the easiest method in mounting boxes.
  - A. By screw
  - B. by nail
  - C. by electrical tape
  - D. by glue
11. How many maximum numbers of wire in a 4x2 1/8 x 1 7/8 inches utility type of box?
  - A. 4
  - B. 5
  - C. 6
  - D. 7
12. The primary function of the electrical box.
  - A. Maybe required by the PEC
  - B. To house electrical connections

- C. To have a good design
  - D. It is the suggestion of the owner of the building
13. It is one of the characteristics of weatherproof boxes.
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  - B. Used for exterior switches or receptacles not advisable.
  - C. They are thicker than interior boxes and has a rubber gasket between the cover and the box to keep out water.
  - D. The boxes are exposed without any cover.

For questions number 14 and 15.

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- A. Ceiling box
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