Senior High School

DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar in Electrical Installation and Maintenance (EIM)

Quarter 1

LE
5

Lesson Exemplar for Electrical Installation and Maintenance
Quarter 1: Unit 1

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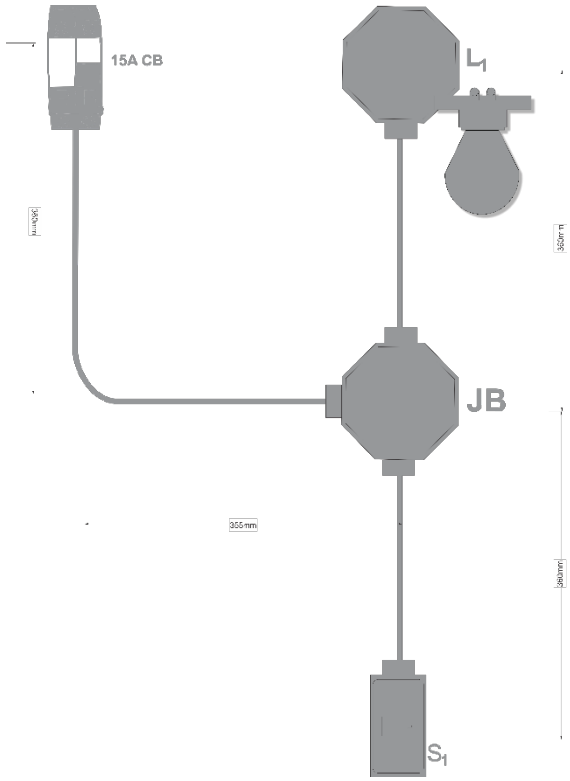
UNIT LESSON EXEMPLAR			
Learning Area	TECHPRO-EIM	**Grade Level**	11
Semester	1	**Quarter**	1
Writer/s	Rhenan C. Loseo		

I. OBJECTIVES *(Identifying the Goals)*	
Content Standard	**Content Standard:** The learners demonstrate an understanding of roughing-in activities for residential/building wiring systems.
Performance Standard	**Performance Standard:** The learners perform roughing-in activities for residential/building in accordance with the PEC standard.
Learning Competencies	**Perform Procedures for Installing Electrical Non-Metallic and Metallic Conduits**
II. REFERENCES and MATERIALS (*Selecting Resources and Materials*)	• *Pita N. (2015). Electrical Installation and Maintenance. Phoenix Publishing House.* • *Gonzales, R. M., & del Rosario, R. C. (2018). Electrical Installation and Maintenance NC II (TVL K to 12). Rex Book Store.* • *Perez, E. L., & Tan, F. C. (2017). Electrical installation and maintenance: Learning module. Department of Education – Learning Resources Management and Development System.* • *Department of Education. (2016). K to 12 Basic Education Curriculum: Electrical Installation and Maintenance Learning Module (Grade 11 and 12). Bureau of Learning Resources.* • *TESDA Training Regulation_EIM NC 2, s. 2015* • *Training Materials* **1. Metallic conduits/non-metallic conduits** 1.1 Rigid Steel Conduits (RSC) 1.2 Intermediate Metallic Conduit (IMC) 1.3 Electrical Metallic Tubing (EMT) 1.4 Polyvinyl Chloride Pipe (PVC) 1.5 Non-metallic flexible conduit (NMFC) **2. Fittings** 2.1 Condulets and Reducers 2.2 Lock nut and bushing 2.3 Entrance cap 2.4 Nipple 2.5 Elbow

	2.6 PVC/Metal fittings and Connectors **3. Accessories** 3.1 Electrical Boxes • Utility Box • Junction Box • Pull box/Splice box 3.2 Conduit supports (e.g. hangers) 3.3 Conduit Strap 3.4 Connectors (straight and angled) **4. Tools and equipment** Including but not limited to: 4.1 Spirit level, hack saw, pipe cutter, plumb bob, pipe reamer, pipe threader, pipe bender, bolt cutter, electric drill, heat gun, measuring tape 4.2 Electrical power tools - Power drills - Portable grinder	
III. CONTENT	**1.** Non-Metallic and Metallic Conduit Installation Procedures • Electrical layout review • Non-metallic conduits (PVC, CPC) • Metallic conduits • Cable trays, terminal cabinets, and distribution panels	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	*By the end of the lesson, learners must be able to:* 1. Identify tools, materials, and equipment needed; 2. Calculate the lengths and angles of bends of electrical conduits; 3. Perform the various types of bending for electrical conduits.	
IV. PROCEDURES		
A. Activating Prior Knowledge	**1. Real-Life Connections (Day 1 – 1 Hour)** **1.1 Strategy:** Start with a discussion about experiences at home or in the community. "Before we begin calculating, you need to consider the type of bend, conduit size, and the bender's radius required for the task. Let's remember some basics about electrical conduits. An electrical conduit is a protective tubing system that secures electrical wiring in buildings and industrial environments. The types of electrical conduit are categorized based on the materials they are made from.	**ANNOTATION** The teacher can adapt lessons to suit various student levels, including beginners and advanced learners, using available materials and resources. This ensures that everyone can learn in the way that works best for them. In this part of the lesson, the SHS IDF outlined in this plan is both reflective

	1. Metallic Non-Flexible Conduit 2. Metallic Flexible Conduit 3. Non -metallic Non-Flexible Conduit 4. Non-metallic Flexible Conduit Example: "You are an apprentice electrician working on-site for a commercial office renovation. The job requires running EMT (Electrical Metallic Tubing) conduit from the main electrical panel to multiple office rooms, around walls, and into ceiling-mounted light fixtures." *(This connects familiar situations to formal concepts like roughing-in)* **2. Use Images or Videos** **Strategy:** Show photos or short clips of roughing-in and electrical tools.  *SHS learners showing their skills in roughing in* • Non-Metallic Non-Flexible Conduit Polyvinyl Chloride (PVC) Bending https://www.youtube.com/watch?v=XqXwbtKV7xk **Activity: "Conduit Relay Race" –**	and ideational. It is reflective because the teacher's questions will encourage learners to connect their personal experiences or previous encounters with performing roughing-in activities, whether from home, media, or school. This will help them evaluate and expand their existing knowledge. It is ideational because learners are prompted to express their thoughts and prior knowledge about performing roughing-in activities, fostering a deeper understanding of the subject matter. The lesson includes: • Relevance, enabling learners to connect rough in activities to familiar contexts like home and community setups. • Responsiveness, as strategies are tailored to learners' backgrounds and experiences, fostering recognition and active participation.

	Divide the class into small groups. Each group must race to assemble a mock conduit installation using provided materials (tape, string, etc.) while adhering to safety protocols. This energizer promotes teamwork and sets the stage for the lesson.  Can you identify any tools, materials, and equipment that you recognize? *Note: It can be redrawn or sketched by the illustrator.*	**Instructional** **Materials:** Whiteboard, markers, and conduit samples.

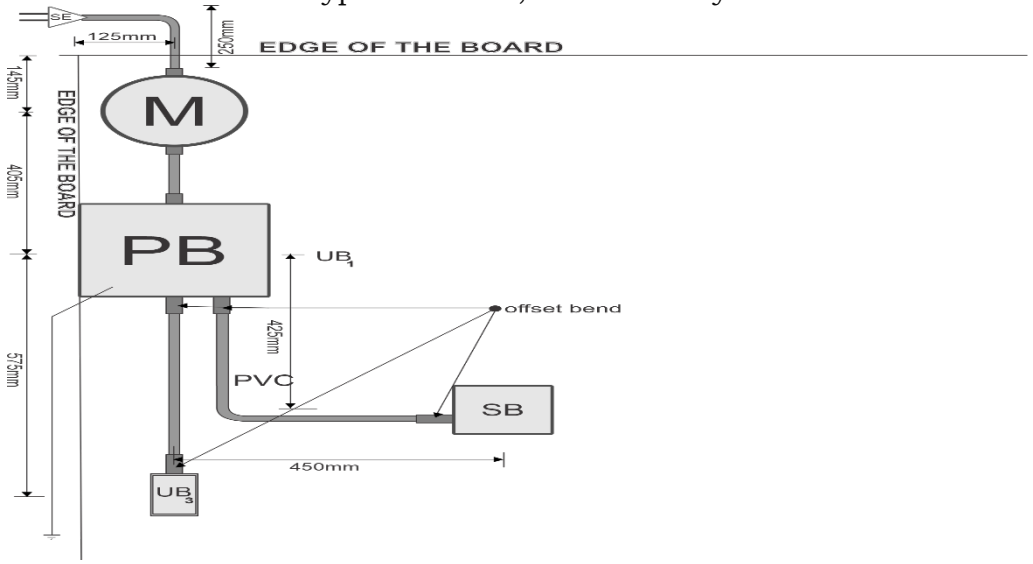
<table>
<tr>
<td></td>
<td>What are the basic types of bends, and how do you calculate them?
 

Figure 1: Bending Exercise. All electrical conduits from the service entrance to UB3 is EMT. From Panel Board to Square Box is PVC

This helps students recall and link their visual memory with new terms and concepts.</td>
<td>The guided questions focus learners on key components tools, materials and equipment needed, types of bend, and safety, enhancing practical understanding and engagement. The peer-sharing format encourages perspective comparison and misconception correction in a supportive manner.

The teacher acts as a facilitator, circulating during group analysis to prompt deeper thinking and maintain focus, while also gaining opportunities for formative assessment.</td>
</tr>
<tr>
<td>B. Instituting New Knowledge</td>
<td>"Getting to Know Your Tools, Materials, and Equipment" Day 1 -1 Hour

<table>
<tr><td>Equipment:</td></tr>
<tr><td>Heat Gun</td></tr>
<tr><td>Portable Grinder</td></tr>
<tr><td>Materials:</td></tr>
<tr><td>Pencil/marker/chalk</td></tr>
<tr><td>Electric Metallic Tubing (EMT)</td></tr>
<tr><td>Polyvinyl Chloride (PVC)</td></tr>
<tr><td>Fittings</td></tr>
</table></td>
<td>The teacher will introduce the necessary tools, materials, and equipment for the task needed, as well as demonstrate proper handling techniques.</td>
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</table>

Straight Connector
Tools
Measuring Tape
Spirit level
Hacksaw
Pipe cutter
Wet Rug
Try Square
Screwdrivers
Personal Protective Equipment
Gloves
Respirator
Googles

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1.1 Common conduit bending terms:

A. Bend angle — the angle you bend the pipe (like 30°, 45°, 90°)
B. Radius — how wide the bend curves
C. Take-up — how much length is "used" in a 90° bend (depends on bender tool and pipe size

1.2 Types of bending for electrical conduits

A. 90° bend (right angle) — also called an "L bend"
B. Offset bend — for going around an obstacle
C. Stub-up bend — rises from a surface
D. Back-to-back bend — two 90° bends to form a U-shape

1.3 Metallic Non-Flexible Conduit Day 2
Electric Metallic Tubing (EMT) Bending
https://www.youtube.com/watch?v=vQ2AQy5Gfxs&t=3s

1.4 Non -Metallic Non-Flexible Conduit
Polyvinyl Chloride (PVC) Bending
https://www.youtube.com/watch?v=HjWLXRc92sY

The teacher will present a video clip for **Roughing-In Process** showing types of bends and common terms used in rough-in activities. Suggested video links are provided below.;

1.https://www.youtube.com/watch?v=vQ2AQy5Gfxs&t=3s

	How to Present: Electricians install conduits and boxes before any wires are connected during the rough-in stage. A comparison is like building the electrical system's framework. **Purpose:** Visualizes the step-by-step process. **2. Problem-Based Learning Day 3** **2.1 Strategy:** Give a practical scenario or problem to solve. **Example:** **Electrical Installation Scenario**: You are tasked with wiring a small storage room according to the Philippine Electrical Code (PEC) standards. The room requires: **3.** 2 Lighting fixtures **4.** 1 Switch controlling the lights **5.** 1 Convenience outlet List the steps for routing the cable and discuss possible approaches for electrical rough-in and installation. **Activity 2.2 Bending 90^0 Polyvinyl Chloride (PVC) Day 4** Your task is to perform 90^0 bends of PVC pipe properly using the needed tools, materials, and equipment. You should follow the procedures correctly. **Procedures in Bending 90^0 Polyvinyl Chloride (PVC)** (refer to Figure 1, Bending Exercise) 1. Prepare the necessary tools, materials, and equipment 2. Analyze the given electrical drawing	2.https://www.youtube.com/watch?v=HjWLXRc92sY . The teacher will demonstrate the proper technique for bending different types of electrical conduit, with a focus on the concept of scaffolding. The learners will re-demonstrate various techniques for bending electrical conduit for mastery.

3. Wear appropriate PPE
4. Use a try square and chalk to mark a right angle on the floor. This will guide you in forming your electrical conduit at 90-degree angles.
5. In a room with a tiled floor, use the corner for 90-degree angles.
6. Draw a 100 mm arc near the corner to shape your elbow correctly.
   Note: A 20mm diameter pipe of PVC should have a radius of 100mm.
7. Measure the PVC pipe length and mark the 90-degree angle center. Then measure 100mm on both sides.
8. Plug in the heat gun and heat the conduit evenly, focusing on 100mm areas on both sides of your markings. Rotate the conduit and sway the heat gun to prevent kinks and burns while bending.
9. When the conduit softens, it will sag. Turn off the heat gun and bend the PVC to the desired shape using the arc and 90-degree angle drawn on the floor.
10. Dampen the formed shape with a wet rag to harden it immediately. (Use your foot to hold one end while wiping.)
11. Observe good housekeeping.

Assessment Criteria

Dimensions	**VS** **5**	**S** **3**	**NI** **1**
1. Quality: Workmanship, Appearance, Bending 90-degree Angle			
2. Accuracy: Dimension, Accurate bending			
3. Method: Observance of the safety measures			
4. Speed: Submission on time + 1, before the expected time +2, after the expected time -2			

Rating Scale:

VS- Very Satisfactory = 20-16

S - Satisfactory = 15-10
NI – Needs Improvements = 9 – below

Activity 2.3 Offset Bending Polyvinyl Chloride (PVC)

(refer to Figure 1, Bending Exercise)

Your task is to offset bends of the PVC pipe properly using the needed tools, materials, and equipment. You should follow the procedures correctly.

Procedure in Offset Bending Polyvinyl Chloride (PVC)

1. Prepare the necessary tools, materials, and equipment.
2. Analyze the given electrical drawing.
3. Wear appropriate PPE.
4. Measure the obstruction's elevation using the wooden box. Use an offset bend if the conduit crosses. The elevation is approximately 70mm.
5. Mark the elevation depth on the floor with a try square and chalk to guide your offset bend height.
6. You should have two parallel lines on the floor.
7. Mark off the 100mm from the end of the PVC pipe. This will be the center of the first bend of the offset.
8. Put another mark of about 20mm from your first marker.
9. Plug in the heat gun and heat the conduit evenly, focusing on 100mm areas on both sides of your markings. Rotate the conduit and sway the heat gun to prevent kinks and burns while bending
10. When the conduit softens, it will sag. Turn off the heat gun and bend the PVC to the desired shape, pulling one end while pushing the other.
11. Dampen the formed shape with a wet rag to harden it immediately. (Use your foot to hold one end while wiping.)
12. Observe good housekeeping.

Assessment Criteria

Dimensions	**VS** **5**	**S** **3**	**NI** **1**

1. Quality: Workmanship, Appearance, Offset Bending				
2. Accuracy: Dimension, Accurate bending				
3. Method: Observance of the safety measures				
4. Speed: Submission on time + 1, before the expected time +2, after the expected time -2				

Rating Scale:

VS- Very Satisfactory = 20-16
S - Satisfactory = 15-10
NI – Needs Improvements = 9 – below

Activity 2.4 Offset Bending for Electrical Metallic Tubing (EMT)

Your task is to offset bends of EMT pipe properly using the needed materials, tools, and equipment. You should follow the procedures correctly.

Procedures in Offset Bending for Electrical Metallic Tubing (EMT)

1. Prepare the necessary tools, materials, and equipment.
2. Analyze the given electrical drawing.
3. Wear appropriate PPE
4. Mark the first Bend. Measure 2.5 inches from the conduit end and mark this point as the “start of offset.”
5. Make the first bend (downwards). Position the bender with the handle up. Insert the conduit into the bender’s shoe and align your “start of offset” mark with the arrow. Apply steady pressure to bend the conduit downwards at a small angle, for a typical box offset “slight kick” about 10-20 degrees.
6. Mark the second bend's offset distance. After the first bend, lay the conduit flat and allow about 2 inches of travel for a small angle. Make the second bend upwards by rotating the conduit and bender 180 degrees, so the previously bent part is now pointing upwards.

7. Flatten your work and check the offset. Examine the rise you created to see if it matches your needs.
8. Make adjustments as necessary. If the offset is insufficient, you may need to slightly increase the angle at both ends
9. Observe good housekeeping.

Assessment Criteria

Dimensions	**VS** **5**	**S** **3**	**NI** **1**
1. Quality: Workmanship, Appearance, Offset Bending EMT			
2. Accuracy: Dimension, Accurate bending			
3. Method: Observance of the safety measures			
4. Speed: Submission on time + 1, before the expected time +2, after the expected time -2			

Rating Scale:

VS- Very Satisfactory = 20-16
S - Satisfactory = 15-10
NI – Needs Improvements = 9 – below

Activity 2.5 90 degrees Bending for Electrical Metallic Tubing (EMT)

Your task is to properly bend 90-degree bends of EMT pipe using the needed materials, tools, and equipment. You should follow the procedures correctly.

Procedures for 90-degree Bending for Electrical Metallic Tubing (EMT)

1. Prepare the necessary tools, materials, and equipment.
2. Analyze the given electrical drawing.
3. Wear appropriate PPE

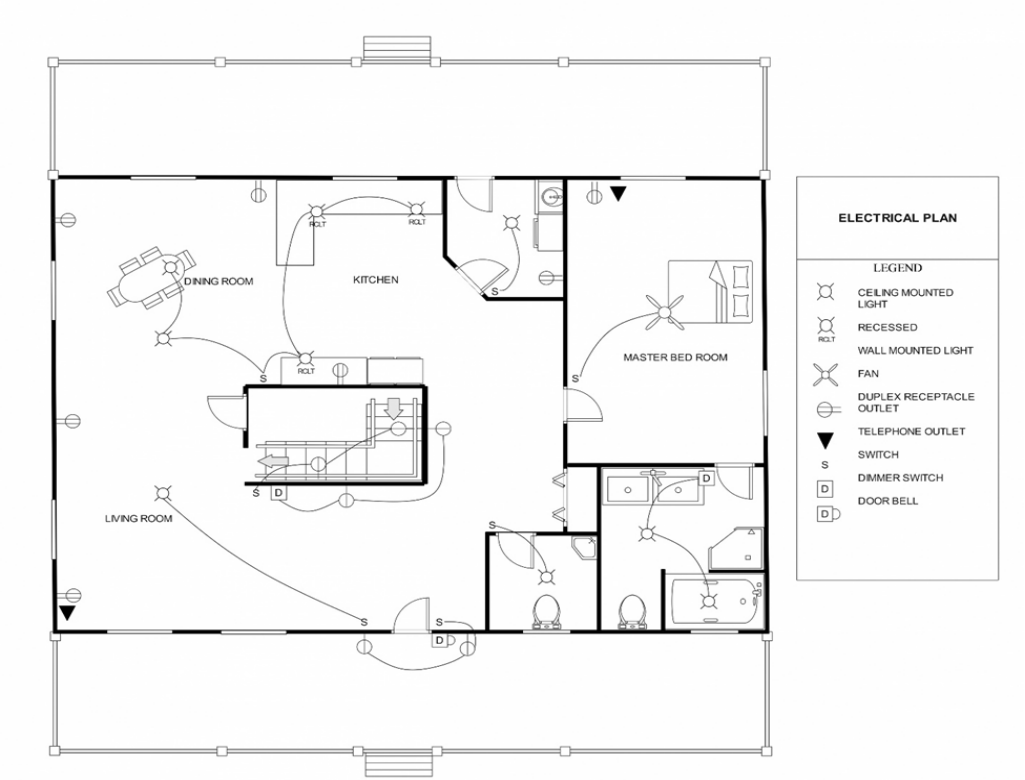
4. Decide your stub height: How tall do you want the vertical part of your "L"? Let's say you want it 10 inches
5. Find your bender's "take up": Look at your bender. It usually has a number stamped on it or a sticker. For ½ ", EMT is 5 inches, for ¾ is 6 inches. Let's assume ½" EMT
6. Calculate your mark:
    - Subtract the take-up from your desired stub height
    - Examlple:10 inches (desired stub height)- 5 inches (take-up) = 5 inches
    - These 5 inches is where you'll make your mark on the conduit
7. Mark the conduit:
    - Measure 5 inches from one end of your EMT conduit.
    - Make a clear mark with a pencil or marker at this 5-inch point
8. Position the bender:
    - Put your bender on the ground with the handle pointing up
    - Slide the conduit into the bender's shoe
    - Line up your mark with the arrow on the bender shoe. Ensure that the end of the conduit you're bending is going away from the bender handle.
9. Bend the Conduit:
    - Put one foot firmly on the heel of the bender (The little pedal on the ground) to hold it steady.
    - Pull the bender handle smoothly and steadily towards you.
    - Keep the bending until the conduit forms a perfect 'L' shape. Benders have a sight line or a level bubble to help you know when you've hit the 90-degree mark.
    - The part of the conduit that was in the bender will now be pointing straight up.
10. Check:
    - Take the conduit out of the bender.
    - Measure the vertical part (the Stub). It should be very close to your desired 10 inches.
11. Observe good housekeeping.

Dimensions	**VS** **5**	**S** **3**	**NI** **1**

	1. Quality: Workmanship, Appearance, Offset Bending 2. Accuracy: Dimension, Accurate bending 3. Method: Observance of the safety measures 4. Speed: Submission on time + 1, before the expected time +2, after the expected time -2 **Rating Scale:** VS- Very Satisfactory = 20-16 S - Satisfactory = 15-10 NI – Needs Improvements = 9 – below	
C. Demonstrating Knowledge and Skills	**I. Practical Application** **1. Residential Construction** • **Application**: Interpreting electrical plans to install switches, outlets, and lighting in a new house. • **Real Scenario**: An electrician uses the floor plan to mark the exact points for conduit rough-in and prepares appropriate lengths of THHN wires and junction boxes. **2. Commercial Building Projects** • **Application**: Selecting proper wire gauge, cable trays, and laying out structured cabling systems in offices or commercial spaces. • **Real Scenario**: A team installs power distribution and data lines following a detailed schematic that complies with building codes and safety standards. **3. Renovation or Retrofitting Work**	"The teacher will present and discuss with learners the various practical applications and real-life scenarios related to electrical work, including roughing-in activities.

	• **Application**: Updating outdated electrical systems by reading original blueprints and adjusting for new appliances or lighting. • **Real Scenario**: The installer identifies which circuits need to be rerouted or upgraded to accommodate a new HVAC unit. **4. Preventive Maintenance and Troubleshooting** • **Application**: Using electrical plans to trace wiring paths and access points when diagnosing power failures. • **Real Scenario**: A maintenance technician uses the wiring layout to find the origin of a short circuit in a hospital's emergency lighting system. **5. Compliance and Safety Audits** • **Application**: Ensuring that installation work aligns with the National Electrical Code (NEC) or the Philippine Electrical Code (PEC). • **Real Scenario**: During inspection, a certified electrician compares the as-built installation to the electrical plan to verify correct rough-in depths, box fill, and grounding. **Activity Suggestion for Learners**	

Task: "Review this simple floor plan.



Identify and label where rough-in work must occur. List the tools and materials you'd prepare for this job."

Real Scenario: As part of a house renovation, you are tasked with installing electrical conduit for new electrical outlets and lighting. High ceilings, concrete walls, modern electrical panels.

2. Simulation Activity: Electrical Rough-In Installation

Learners will demonstrate their ability to plan, lay out, and install a basic residential rough-in electrical system, including electrical boxes, conduits or cables, and wire routing.

Given the necessary materials, tools, and equipment, you will perform the task according to the set performance criteria.

Tools, Materials, and Equipment Needed

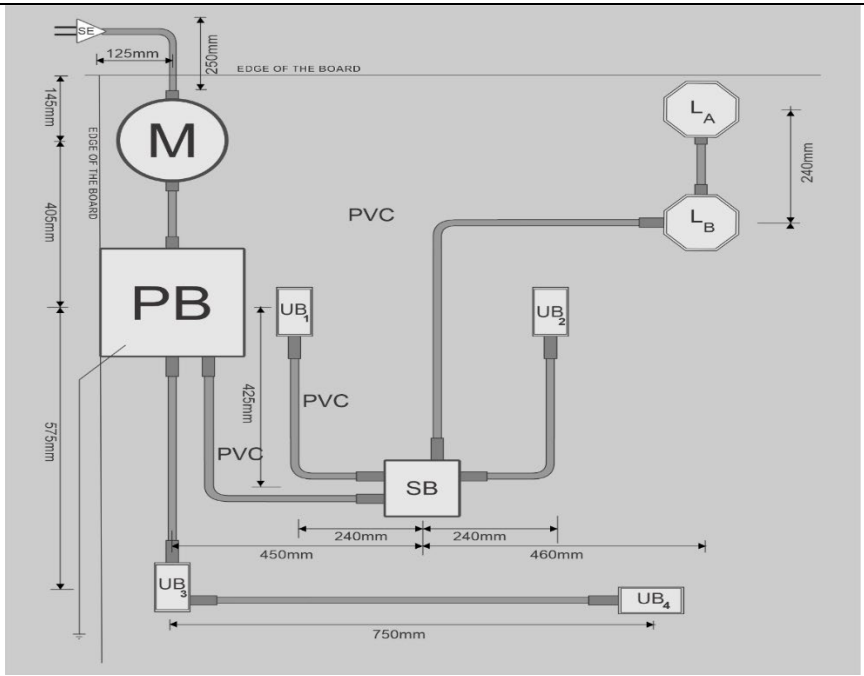
Equipment:	**Unit**
Heat Gun	1 pc
Materials:	
Pencil/marker/chalk	1pc
PVC pipe	1 length
EMT	1 length
Meter Box	1pc
Panel Board	1pc
Utility box	4pcs
Square box	1pcs
Junction box	2pcs
fittings	12pcs
EMT connectors	8pcs
PVC Straight Connectors	8pcs
Tools	
Measuring Tape	1pc
Spirit level	1pc
Hacksaw	1pc
Pipe cutter	1pc
Pipe Bender	1pc
Wet Rug	1pc
Try Square	1pc
Personal Protective Equipment	
Gloves	1pc
Respirator	1pc
Safety google	1pc

The teacher will explain the procedure for simulating the rough-in activities and provide a wiring diagram. Students will then demonstrate their ability to plan, lay out, and install a basic rough-in electrical system. The teacher may adjust the lesson based on the availability of learning resources.

NOTE:

1. All measurements must be in millimeters in the unit
2. Dimensions and mounting boxes must be center-to-center
3. A 1/2" electrical conduit will be used for the service entrance and meter base to the panel board
4. A 1/2" electrical conduit will be used for lighting and Convenience outlets.
5. For electrical conduits that is more than 1 foot perform offset bending
6. Use metallic conduit for UB4, UB3 and from the square box to UB2 and the rest will be non-metallic non-flexible (PVC).

This activity highlights the SHS IDF 3Rs—Relevant, Reflective, and Responsive. It engages learners in practical scenario analysis (Relevant),



Assessment Criteria

Criteria	Excellent (4)	Good (3)	Fair (2)	Needs Improvement (1)
Plan Interpretation	Accurate	Minor errors	Several errors	Misinterpreted
Conduit Installation	Precise, clean bends	Minor misalignment	Several misalignments	Poorly done
Box Mounting	Secure & level	Slightly off level	Loose or tilted	Unusable
Safety Practice	Always observed	Occasionally observed	Rarely observed	Ignored
Workmanship	Neat and organized	Minor clutter	Cluttered	Messy and unsafe

encourages critical thinking through guided questions and comparisons (Reflective), and supports diverse learning preferences via group collaboration and visual materials (Responsive). It also connects real-world applications to technical concepts, fostering Context and Connection between prior knowledge and industry practices.

This activity showcases the ability to conduct electrical rough-in work following the electrical plan, Philippine Electrical Code (PEC), and occupational safety standards.

The learner shall conduct an electrical rough-in activity, which includes the layout, measurement, cutting, bending, and installation of electrical conduits and junction/outlet boxes according to a specified floor plan. This phase prepares for wire pulling and device installation.

A complete and correctly installed rough-in electrical system (conduits and boxes), tested for alignment and layout accuracy, ready for wire pulling.

Rating Scale:

VS- Very Satisfactory = 20-16
S - Satisfactory = 15-10
NI – Needs Improvements = 9 – below

Student's name	
Trainer's name	
Qualification	**ELECTRICAL INSTALLATION AND MAINTENANCE**
Module Title	***Installing electrical non-metallic and metallic conduits.***
Date of assessment	
Time of assessment	8:30 a.m. to 10:30 a.m.

Instructions for demonstration

Given the necessary materials, tools and equipment, the students/ trainee must be able to ***perform procedures in installing electrical non-metallic and metallic conduits*** in accordance with with standard procedures and drawing specifications within 8 hours.

MATERIALS & EQUIPMENT:
Hand Tools, Measuring Tools, Equipment and Accessories, Assorted Supplies and Materials and Assessment Document Forms

PERFORMANCE CRITERIA FOR OBSERVATION	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the students/trainee:	**Yes**	**No**	**N/A**
1. Correct drawings are interpreted based on job requirements.			
2. Correct quantities of conduit, fittings and accessories are determined as per job requirements.			
3. Tools and equipment are selected as per job requirements.			

The teacher will use a demonstration and evaluation checklist to monitor learners' progress and mastery.

4. Conduit is assembled ensuring that fittings are fully inserted and tightened as per job requirements.			
5. Conduit is bent with bends not exceeding 90° as per job requirements.			
6. Conduit couplings and elbows are installed as per job requirements.			
7. Conduit is threaded in line with job requirements.			
8. Safety procedures are followed in line with standard operating procedures (SOPs).			

The trainee's demonstration was:

Satisfactory ❑ Not Satisfactory ❑

GUIDE QUESTIONS	**Satisfactory Response**	
The trainee should answer the following questions:	**Yes**	**No**
[PEC Rules and Regulations]		
1. According to the PEC, what is the minimum burial depth required for underground non-metallic conduit installations?	☐	☐
2. What is the maximum number of 90-degree bends allowed between pull points in a conduit run as per PEC?	☐	☐
3. Under PEC regulations, when is the use of flexible metallic conduit (FMC) allowed instead of rigid conduit?	☐	☐

The learners will be asked will be ask with the guided question to develop, provide scaffolding or clues that can help students think more deeply or locate answers

4. How does the PEC require non-metallic conduits to be supported and secured?	☐	☐	
5. What PEC provisions govern the installation of conduits in wet or damp locations?	☐	☐	
[Safety Questions]	☐	☐	
1. What personal protective equipment (PPE) should be worn when cutting or bending metallic conduits?	☐	☐	
2. Why is it important to de-energize circuits before installing or modifying conduit runs?	☐	☐	
3. What precautions must be taken to avoid damaging non-metallic conduit when securing it to surfaces?	☐	☐	
4. How can improper grounding of metallic conduits pose a safety hazard?	☐	☐	
5. What should be done if a conduit run passes through a fire-rated wall or floor?	☐	☐	
[Contingency Questions]			
1. What should be your immediate action if you accidentally drill into a concealed live electrical wire while installing a conduit?	☐	☐	
2. How do you handle a situation where the specified conduit type is not available on-site, and work is already scheduled?	☐	☐	
3. What steps should you take if water is discovered inside installed non-metallic conduit during rainy weather?	☐	☐	

4. If during installation you find that the conduit route conflicts with structural elements like beams or HVAC ducts, what is the proper procedure?	☐	☐	
5. What contingency plan should be in place if a worker is injured while installing a metallic conduit on an elevated platform?	☐	☐	
JOB ROLE QUESTIONS			
1.What is the primary responsibility of an electrician in a conduit installation project?	☐	☐	
2.What is the role of a foreman or supervisor in ensuring the proper installation of electrical conduits on-site?	☐	☐	
3. How does the job role of a licensed electrician differ from that of a conduit installer in a construction project?	☐	☐	
4. Who is responsible for verifying that all installed conduits comply with the Philippine Electrical Code (PEC)?	☐	☐	
5.What should a helper or apprentice do if they notice incorrect installation of a metallic conduit?	☐	☐	
	☐	☐	
The trainee's underpinning knowledge was: Satisfactory ☐ Not Satisfactory ☐			
Feedback to trainee: Trainee performed all tasks and answered all questions satisfactorily.			
The trainee's overall performance was: Satisfactory ☐ Not Satisfactory ☐			
Students/ Trainee signature:	**Date:**		
Teacher/ Trainer signature:	**Date:**		

GUIDE ANSWER TO QUESTIONS

[PEC Rules and Regulations]

1. According to the PEC, what is the minimum burial depth required for underground non-metallic conduit installations?
Answer Tip: Reference PEC rules on underground conduit installations and protection from physical damage.

2. What is the maximum number of 90-degree bends allowed between pull points in a conduit run as per PEC?
Answer Tip: The PEC typically limits the number of bends to avoid excessive conductor stress.

3. Under PEC regulations, when is the use of flexible metallic conduit (FMC) allowed instead of rigid conduit?
Answer Tip: When flexibility is needed, such as for vibrating equipment or areas with limited space.

4. How does the PEC require non-metallic conduits to be supported and secured?
Answer Tip: *PEC specifies the maximum spacing between supports and the distance from boxes or fittings.*

5. What PEC provisions govern the installation of conduits in wet locations?
Answer Tip: Includes the use of weatherproof fittings, sealed joints, and conduit types suitable for moisture exposure.

Safety questions

1. What personal protective equipment (PPE) should be worn when cutting or bending metallic conduits?
Guide Answer Key

	Answer Tip: Includes gloves, safety goggles, long sleeves, and possibly hearing protection. **2. Why is it important to de-energize circuits before installing or modifying conduit runs?** ***Answer Tip:*** **To** prevent electrical shock, arc flash, or other electrocution hazards. **3. What precautions must be taken to avoid damaging non-metallic conduit when securing it to surfaces?** ***Answer Tip:*** Avoid overtightening straps, use proper fasteners, and keep away from high heat sources. **4. How can the improper grounding of metallic conduits pose a safety hazard?** ***Answer Tip:*** It can create a shock or fire risk if a fault current is not safely carried to ground. **5. What should be done if a conduit run passes through a fire-rated wall or floor?** ***Answer Tip:*** Use firestop materials and maintain the fire rating per local code to ensure safety. **CONTINGENCY MANAGEMENT QUESTIONS** **1. What should be your immediate action if you accidentally drill into a concealed live electrical wire while installing a conduit?** ***Answer Tip:*** Stop work, de-energize the circuit if possible, and report the incident according to safety protocol. **2. How do you handle a situation where the specified conduit type is not available on-site, and work is already scheduled?**	

	Answer Tip: Notify the supervisor, check PEC for allowable substitutions, and do not proceed until approval is given. **3. What steps should you take if water is discovered inside an installed non-metallic conduit during rainy weather?** ***Answer Tip:*** Stop installation, drain and dry the conduit, assess for damage, and ensure proper sealing before continuing. **4. If, during installation, you find that the conduit route conflicts with structural elements like beams or HVAC ducts, what is the proper procedure?** ***Answer Tip:*** Do not alter structural elements; consult with engineers or supervisors to reroute the conduit legally and safely. **5. What contingency plan should be in place if a worker is injured while installing a metallic conduit on an elevated platform?** ***Answer Tip:*** Administer first aid, follow emergency response procedures, secure the area, and complete incident documentation. **JOB ROLE QUESTIONS** **1. What is the primary responsibility of an electrician in a conduit installation project?** *Answer Tip:* To measure, cut, bend, and securely install conduits in accordance with plans and safety standards. **2. What is the role of a foreman or supervisor in ensuring the proper installation of electrical conduits on-site?** ***Answer Tip:*** Oversee the work, ensure compliance with plans and codes, assign tasks, and maintain safety. **3. How does the job role of a licensed electrician differ from that of a conduit installer in a construction project?** ***Answer Tip:*** The electrician handles wiring, connections, testing, and code	

compliance, while the conduit installer focuses on routing and securing conduit systems.

4. Who is responsible for verifying that all installed conduits comply with the Philippine Electrical Code (PEC)?
Answer Tip: The licensed electrical engineer or inspector performs final verification and compliance checks.

5. What should a helper or apprentice do if they notice incorrect installation of a metallic conduit?
Answer Tip: Report the issue to the lead electrician or supervisor and avoid making changes without instruction.

Sample 1: Basic Completion Report for Electrical Works

Project Title: _____
Location: _____
Client: _____
Contractor:
Date Completed:

Scope of Work	**YES**	**NO**
1. Installation of electrical metallic and non-metallic conduits		
2. Wiring of lighting and power outlets		
3. Installation of circuit breakers and main distribution panel		
4. Testing and commissioning of the entire system		

Remarks:

- All materials used conform to the standards of the Philippine Electrical Code (PEC).
- The electrical system was tested and found to be functioning properly.
- Load test and insulation resistance test conducted with satisfactory results.

Submitted by:

Signature:
Date:

Sample 2: Detailed Completion Report (Commercial/Institutional Projects)

PROJECT COMPLETION REPORT ELECTRICAL WORKS

Project Name: _____
Project Location: _____
Client: _____
Contractor: _____
Project Duration:_____
Date of Report: _____

Scope of Work Executed:	**YES**	**NO**
1. Installation of new electrical metallic conduit lines for additional HVAC units		
2. Replacement of damaged non-metallic conduits in utility corridors		
3. Upgrade of main switchgear (2500A) and sub-panels		
4. Installation of energy-efficient LED lighting systems		
5. Integration of electrical works with Building Management System (BMS)		
6. Testing, commissioning, and final inspection		
7. Attach means of verification (photos and videos)		

2. Standards & Compliance:

- All electrical works performed by the **Philippine Electrical Code (PEC 2017 Edition)**.
- Compliance with **SM Safety & Technical Guidelines** and **DOE** standards.
- All installations were inspected by the **Professional Electrical Engineer** (PEE) and the **Owner's Representative**.

3. Testing and Commissioning:

- Continuity, insulation resistance, and grounding tests completed
- Load balancing tested on main panels
- No faults, overloading, or short circuits detected
- Documentation submitted to client for record

4. Attachments:

- As-Built Drawings
- Test Reports
- Photographic Documentation
- Work Completion Checklist

Prepared by:

Reviewed and Approved by:

Please ensure that the Activity Completion Work Report is completed and submitted:

Perform Procedures for Installing Electrical Non-Metallic and Metallic Conduits		
	Yes	**No**
1. Interpret electrical wiring diagrams and mechanical drawings		
2. Identify and check to ensure that tools, equipment, and personal protective		

	equipment are needed for the electrical system			
	3. Install conduit and fittings following the standard			
	4. Identify the techniques for installing and bending conduit			
	5. Bend and install the type of conduit and cable tray as per job requirements			
	6. Perform the installation economically			
	7. Address unplanned events or conditions appropriately.			
	8. Safety procedures are followed in line with the standard operating procedures (SOPs)			
	9. Submit Completion Report			

V. ASSESSMENTS

(Assessing Learnings)

This culminating assessment addresses both the Content Standard (understanding concepts, tools, plans, and procedures) and the Performance Standard (application of skills in realistic contexts).

A 25-item multiple-choice test will be administered to the learner, accompanied by a performance task that includes a rubric.

Lesson: Perform Procedures for Installing Electrical Non-Metallic and Metallic Conduits

Name: _____ Grade/Section: _____ Date: _____

Please read all instructions carefully before starting the exam. Select the most appropriate answer and mark it clearly on the answer sheet.

1. Which of the following is a rigid, metallic conduit type?
   A. PVC
   B. EMT
   C. Rubber tubing
   D. Lead wire

2. Rigid Metal Conduit (RMC) is best used in:
   A. Decorative light fixtures

	B. Outdoor or hazardous areas C. Telephone wiring D. Temporary setups 3. When is Flexible Metal Conduit (FMC) most useful? A. Underwater installations B. Hidden wiring C. Tight spaces where bending is needed D. Wall painting projects 4. PVC conduit is a good choice for: A. Very hot areas B. Wet or corrosive environments C. Fire-prone zones D. Soundproof rooms 5. What fitting is used to connect two pieces of conduit? A. Tee B. Coupling C. Clamp D. Elbow 6. Why are bushings used at the ends of conduit? A. To keep insects out B. To make it look better C. To protect wire insulation from damage D. To increase wire power 7. What is the most common type of conduit bend? A 90-degree bend B. Spiral bend C. Loop D. Zigzag bend 8. What tool is used to bend conduit by hand? A. Wire cutter B. Hammer C. Manual pipe bender D. Drill

9. Which bend helps the conduit go around obstacles?
   A. Back bend
   B. Offset bend
   C. Spiral bend
   D. Arc bend

10. Why is alignment important when installing conduits?
   A. To make it less visible
   B. For good circuit function and appearance
   C. To confuse inspectors
   D. To hold up ceiling panels

11. What should you check before attaching conduit to a wall?
   A. Color of the pipe
   B. That it's painted
   C. Proper alignment and spacing
   D. Whether it’s filled

12. Which tool is best for measuring conduit length accurately?
   A. Screwdriver
   B. Hammer
   C. Tape measure
   D. Wire stripper

13. A digital caliper is used to measure:
   A. Voltage
   B. Inside and outside diameters
   C. Conduit length
   D. Water pressure

14. When measuring for a bend, what’s important?
   A. Ignore shrinkage
   B. Subtract random values
   C. Use reference points
   D. Estimate by eye

15. Saddle bends are used when:

	A. Connecting to a box B. Reducing voltage C. Going over pipes or obstacles D. Holding the conduit vertically 16. To make an accurate offset bend, you need to know: A. The conduit's color B. The offset angle and distance C. The cable's weight D. The circuit's voltage 17. What are cable trays used for? A. Cleaning tools B. Supporting bundles of cables neatly C. Holding connectors D. Painting 18. How can you reduce installation costs? A. Use more conduit than needed B. Don't worry about waste C. Plan and lay out efficiently D. Use oversized wires 19. What's a cost-effective way to install conduit? A. Use random lengths B. Don't measure C. Plan routes with fewer bends and less waste D. Paint the pipes 20. What are conduit straps used for? A. Carrying tools B. Hanging lights C. Holding the conduit in place D. Preventing theft 21. What's an important safety step before working on electrical conduits? A. Wear sandals B. Turn off the power

C. Use your phone
D. Skip safety gear

22. Which of the following is part of Personal Protective Equipment (PPE)?
A. T-shirt and shorts
B. Cap and watch
C. Gloves, goggles, and safety shoes
D. Backpack

23. What commonly causes electrical fire hazards?
A. Loud music
B. Water leaks
C. Overloaded circuits and poor connections
D. Sunlight

24. A proper work completion report should include:
A. Personal opinions
B. A list of materials, tasks done, and any issues
C. Lunch recipes
D. Jokes

25. Why is keeping records and documentation important?
A. To confuse others
B. For future maintenance and reference
C. To do more paperwork
D. To keep secrets from competitors

Lesson Assessment: Perform Procedures for Installing Electrical Non-Metallic and Metallic Conduits
Answer Key

1. B	6. C	11. C	16. B	21. B
2. B	7. A	12. C	17. B	22. C
3. C	8. C	13. B	18. C	23. C
4. B	9. B	14. C	19. C	24. B
5. B	10. B	15. C	20. C	25. B

Table of Specifications (TOS)

Subject: TVL – Electrical Installation & Maintenance
Lesson: Perform Procedures for Installing Electrical Non-Metallic and Metallic Conduits
Assessment Type: Multiple Choice
Total Items: 25

TOS Breakdown by Content Area and Cognitive Level

Content Area	Cognitive Level	No. of Items	Item Numbers
Types and Functions of Conduits	Knowledge	5	1, 2, 3, 4, 5
Conduit Accessories and Fittings	Comprehension	2	6, 7
Tools and Measurement	Knowledge, Application	4	8, 12, 13, 14
Conduit Bending and Installation	Comprehension	4	9, 10, 15, 16
Support Systems (e.g., Cable Trays, Straps)	Comprehension	3	17, 18, 19
Safety Practices and PPE	Knowledge, Comprehension	3	21, 22, 23
Documentation and Reporting	Comprehension	2	24, 25
Pre-Installation Checks	Comprehension	2	11, 20

Breakdown by Bloom's Taxonomy

Cognitive Domain	Items	Percentage
Knowledge	8	32%
Comprehension	13	52%
Application	4	16%
Total	25	100%

VI. REFLECTION
(Feedback and Continuous Improvement)

Sample reflection questions that learners can answer after completing the unit:
Perform Procedures for Installing Electrical Non-Metallic and Metallic Conduits

The teacher will ask questions to solicit students reflections.

Reflection Questions for Students

	1. **What new knowledge or skills did you gain from learning about electrical plans and roughing-in procedures?** *(Encourages learners to recall and internalize key takeaways.)* 2. **What part of the lesson did you find most challenging, and how did you overcome it?** *(Promotes self-awareness and learning from struggle.)* 3. **How can you apply what you learned in real-life situations at home or in future work as an electrician?** *(Helps learners connect theory to practical, real-world use.)* **Teacher Reflection** **Key Highlights:** The simulation's practical exercises, such as roughing in, the learners received positively. During practical simulations and group projects, they demonstrated a high level of participation. Their motivation improved, and the teachings became more practical when actual tools and plans were used. **Challenges Encountered:** A few learners found it challenging to visualize the plan and interpret electrical symbols. Additionally, there were differences in tool handling skills, which caused some group tasks to move more slowly than others. **Adjustment Made:** I scaffolded the tasks and used extra visual aids to facilitate various learners. Before the performance challenges, I included guided worksheet activities and paired difficult students with peer tutors. In order to help students better visualize the layout prior to hands-on work, I intend to incorporate digital simulations sooner in future education.

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