



INSTALLATION CONSTRUCTION WORKS Level - I

Learning Guide –13

Unit of Competence Perform Roughing-In Activities for Communication
and Distribution Systems

Module Title Performing Roughing-In Activities for Communication and
Distribution Systems

LG Code: CON ICW1 M13 LO1-LG-13

TTLM Code: CON ICW1 TTLM 05 19v1

LO No 1:- Install electrical metallic conduit



Instruction Sheet	Learning Guide #-
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This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Interpreting electrical drawings
- .Determining correct quantities of metallic conduit and accessories
- Selecting tools and equipment
- Inserting and tightening conduit
- Bending conduit
- Installing conduit couplings and elbows
- Conduit threading
- cutting required conduit length
- Following Safety procedures

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Interpret electrical drawings
- .Determine correct quantities of metallic conduit and accessories
- Select tools and equipment
- Insert and tightening conduit
- Bend conduit
- Install conduit couplings and elbows
- Thread conduit
- Cut required conduit length
- Follow Safety procedures

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 20.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask your teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” **in page -**.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.



Information Sheet-1

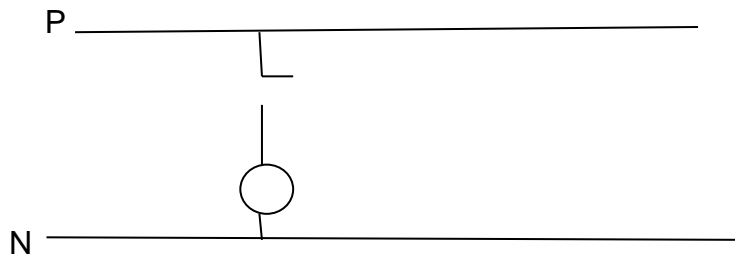
Interpret electrical drawings

Electrical drawing

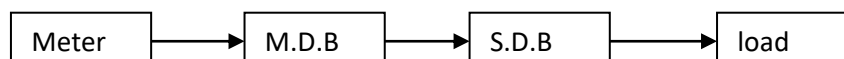
There are different types of electrical drawings .Each drawing has different purpose

The followings are types of electrical drawings used in the circuit

1. Schematic diagram/drawing:- it is used to elaborate /explain the operation of circuit, device ,equipment, etc



2. Block diagram;-indicates the order or arrangement of devices and circuit components.

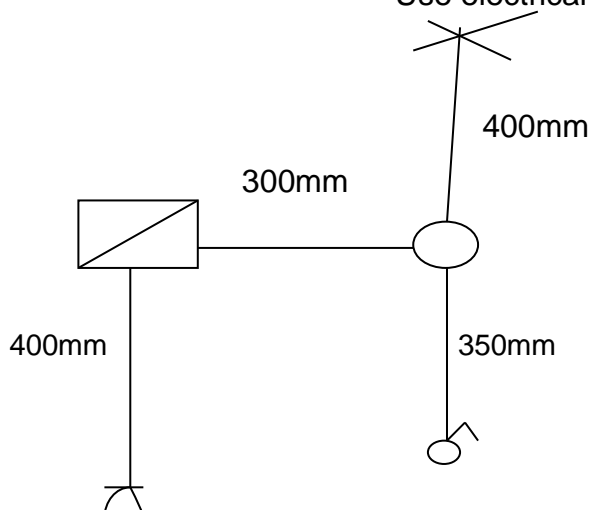


3. Lay out diagram:- it is known as single line diagram

-indicates the type, number and location of devices used in the circuit

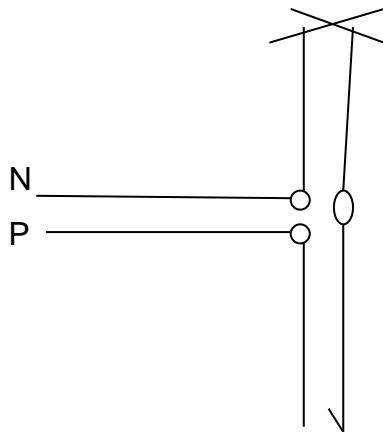
-shows the route and number of wires in the installation

-Use electrical symbols to represent electrical device





2. wiring diagram :-shows the correct/exact connection wires and devices



Self-Check -1	Written Test
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MATCH

A

1. Lay out diagram
2. Wiring diagram
3. Schematic drawing

B

- A .show connection
- B. used for explanation
- c. single line diagram



Information Sheet-2

Determine correct quantities of metallic conduit and accessories

Metallic Conduit

It is a hollow tube made of metal used to insert wires through the tube. Conduit bodies come in various types, moisture ratings, and materials, including galvanized steel, aluminum, and PVC. Depending on the material, they use different mechanical methods for securing conduit. Among the types are:

1. Light gauge conduit
2. Heavy gauge conduit

The light gauge conduit is used for cheap work. It is not water tight and even damp proof and is not permitted for voltage exceeding 250v.

Heavy gauge conduit is used for medium voltage and circuits in place where good mechanical protection and absolute protection from moisture is desired. Galvanized conduit is also used, especially in damp situations when the conduit is on the surface but under ordinary conditions buried in walls it offers little, if any advantage over good enameled conduits.



Advantage of steel conduit include

1. Good protection against mechanical damage
2. Complete protection against fire due to short circuit
3. Water proof
4. used as protective conductor



Disadvantage

1. Very costly
2. Erection is difficult and take long time
3. Require experienced and highly skilled labour
4. May cause short circuit
5. Must need fittings

Self-Check -2	Written Test
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1. Which of the following is advantage of steel conduit?

- a. Costly b. cause short circuit c. resist mechanical damage d. easily burnt

2. Metallic conduit is used –

- a. Very high voltage installation b. under moisture areas c. dry areas d. a & b

Information Sheet-3	Select tools and equipment
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Metallic tools

In the work shop, materials (especially metals like pipes) are cut and bend to shape before filing. The numerous types of tools used for cutting, drilling and bending purposes.

For Cutting

Hacksaw

This has a steel frame, which can be turned at right angles for cutting deep into the material. The blade is secured in the rigid frame. The teeth point **forward** to enable the saw to cut on the forward stroke.

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Metalwork Technology

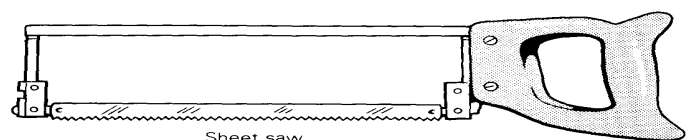
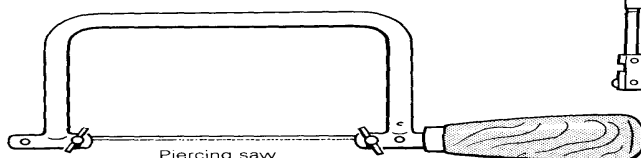
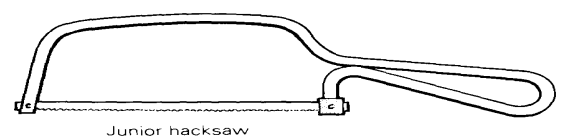
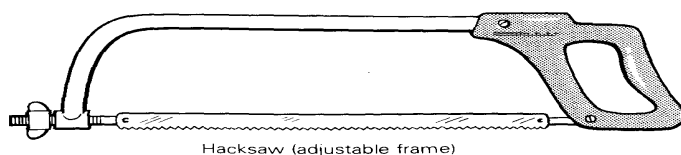


Figure 4.8 Types of saw.



Filing

Filing is a method of removing metal, and the file which is the most widely used hand tool in the school workshop, is used for this cutting operation. It is made of carbon tool steel containing about 1.3 per cent carbon

Types of file section

The commonly used types of file (are as follows.

The hand file has a constant width; it has a safe or smooth edge. It is used in corners where one face only is to be filed.

The flat file tapers throughout its length. The faces are double cut but the edges are only single cut. It is used for general bench work.

The square file has teeth on all four sides, which are parallel for two-thirds of the file length.

It is used for shaping square slots and grooves.

The round file, as its name implies, has a round cross-section. When the file is tapered as well, it is known as a rat tail. Some round files are parallel throughout their length.

The round file is used for enlarging holes and for working in curved areas.

The triangular file is sometimes referred to as **three square**. It is double cut on all three sides. It has a section that is an equilateral triangle, and this makes it useful for getting into sharp corners. es into contact with the work.

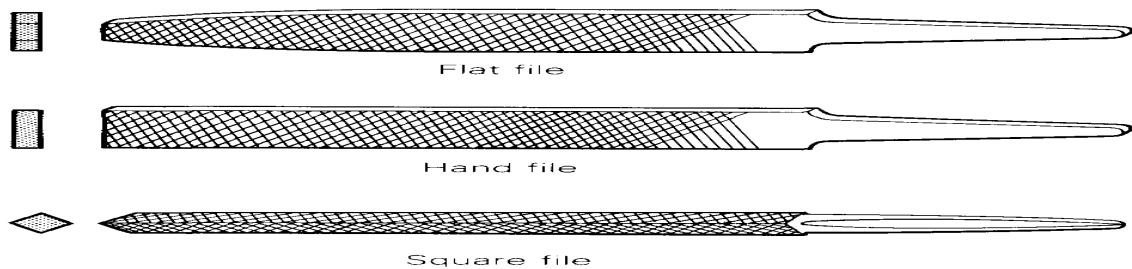


Figure 4.3 Types of file section.

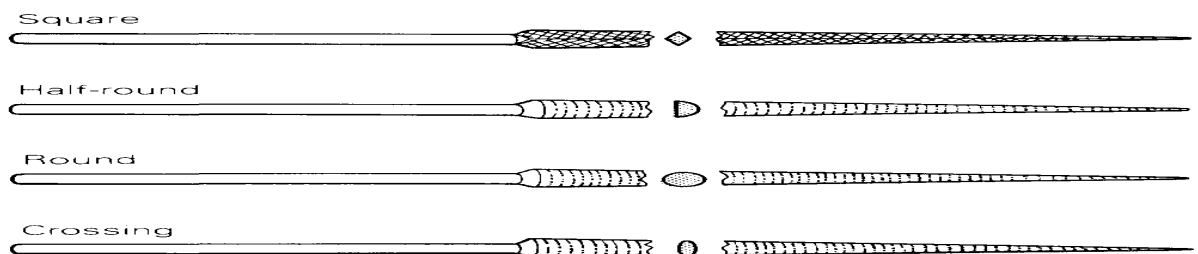


Figure 4.4 A range of needle files.

Drill and lap holes

Drilling is a process of producing round holes in a solid material or enlarging existing holes with the use of multi tooth cutting tools called **drills or drill bits**.



Drilling is used to drill a round blind or through hole in a solid material. If the hole is larger than 30 mm, it's a good idea to drill a smaller pilot hole before core drilling the final one. For holes larger than 50 mm, three-step drilling is recommended

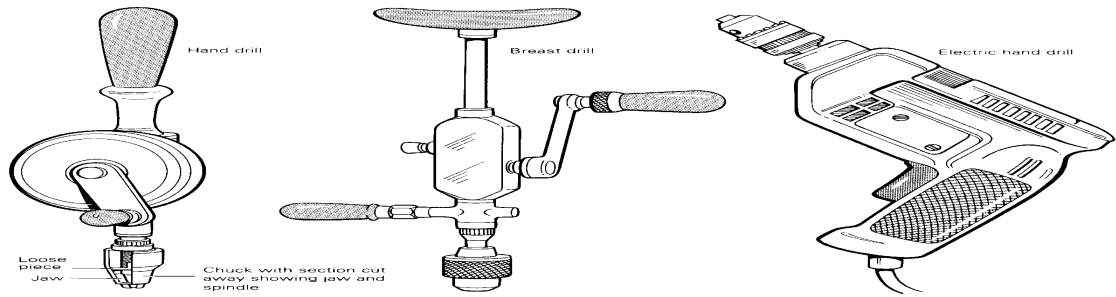


Figure 4.28 Types of hand drill.

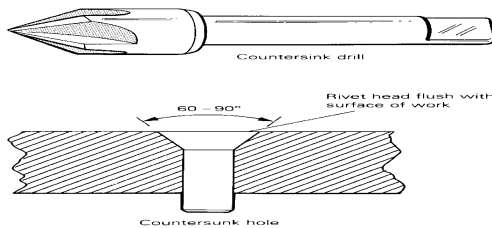


Figure 4.29 Countersinking.

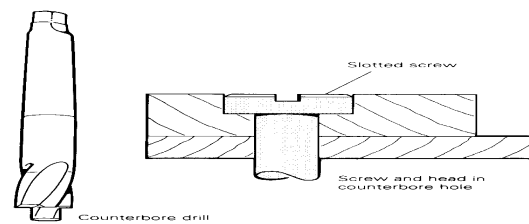


Figure 4.30 Counterboring.

Conduit bender

This device is used to bend metals at the required angle . The most commonly-used types of bends can be quickly, efficiently, and economically made by a knowledgeable and experienced installer.

Self-Check -3	Written Test
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Self check

1 Describe the purpose of the following hand tools and equipment :

- i) files
- ii) saws
- iii) benders
- iv) drills



Information Sheet-4

Thread and Bend conduit

Conduit Cutting and Threading Guidelines

- Close attention to measuring the exact length of conduit needed is important for a quality installation
- Field threading is to be performed using dies
- Importance of thread length should be considered
- Protection of field cut threads:- requires that where corrosion protection is necessary and the conduit is threaded in the field, the thread shall be coated with an approved electrically-conductive, corrosion resistant compound
- Cutting EMT Cut the EMT square using a hack saw or band saw.
- Do not use roll-type tubing cutters. use of tools is to select the right type and the right size

Bending Guidelines

Bend is a curvature of the conduit or tubing made so the raceway will fit a specific geometric location. This can be a factory elbow or can be a field bend of the raceway.

The variety of electrical installations makes field bending necessary. While a full range of factory elbows are readily available. Variability of stubs, back-to-back, offset, and saddle bends encountered in the field-routing of conduit and EMT. These most commonly-used types of bends can be quickly, efficiently, and economically made by a knowledgeable and experienced installer. The skills needed to obtain a level of proficiency are readily learned and require knowledge of basic mathematics, industry terminology and bending tools. Manufacturers of bending equipment publish manuals for each specific bender model which provide excellent in-depth information on bending conduit. The information in this section is supplemental to that provided by the manufacturers. Contact bender manufacturers for complete information

Self-Check -3

Written Test

- 1.Changing the direction of conduit at required angle is
A. tread b. bend c. cut d file
- 2.Whihc one is used to tread metallic conduit?
a. Hand drill b. Bender c. Dies d. wrench

Information Sheet-5

Installing conduit couplings and elbows

Conduit Accessories

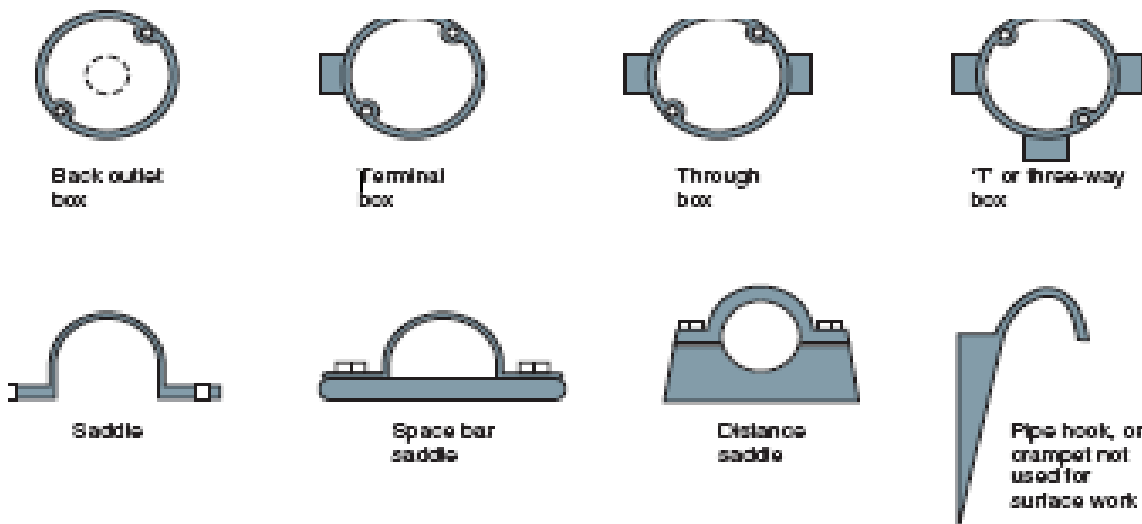
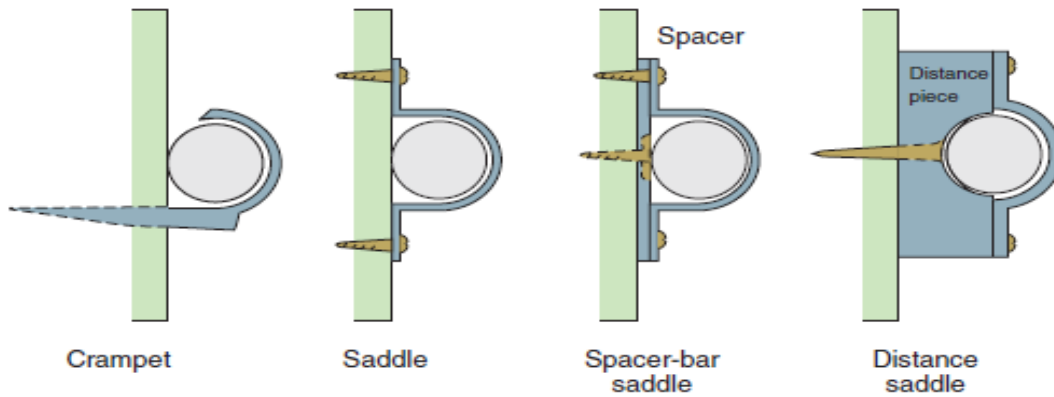
The following Figure shows the common methods used for securing or fixing conduit.



1. **Crumpets** are used for securing conduit in place prior to covering with plaster.

Spacer-bar types are often used to space the conduit out from a wall in order to avoid the need for 'sets'

Fig. Conduit supports.

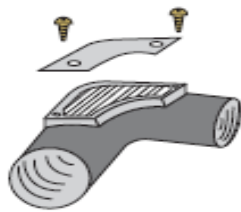


2. **Elbows** are other accessories for use with conduit bends (sharp 90 ° bends) and tees. All of these are available in the inspection and non inspection varieties.

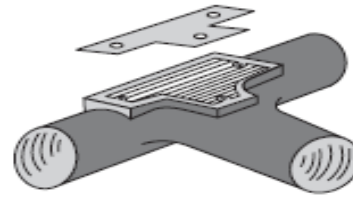
3. **Junction boxes** are also circular boxes with removable lids, to permit ease of wiring a conduit system. The connection terminate in the box for onward connection to the lamp and down ward to the switches. These boxes are also used for distribution and inspection of electrical system.

Some of these accessories are shown in Fig. below

Fig. conduit accessories



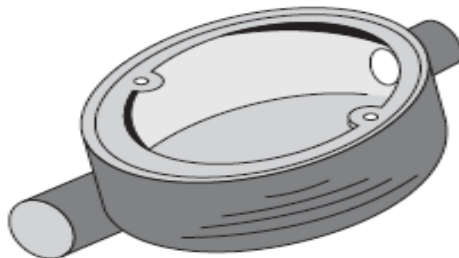
Inspection elbow



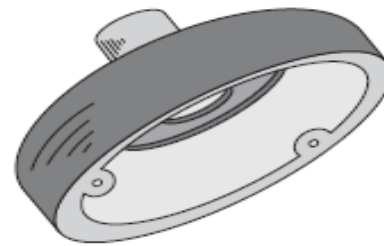
Inspection tee



Non-inspection bend (90°)



Straight-through box



Back-entry box
(useful for light fittings)

4. **Saddle**:-it is used to held conduits with the wall. It has two holes for fixing it with wall on both sides .The conduit is held within its curved surface
5. **Clip**:-Its purpose is similar to that of saddle with difference that only one raw of fixing holes in the wall is required .It cannot hold more than one conduit at a time. Its grip may not be as firm as that of saddle as it is held only at one place. It is used in surface conduit wiring for holding the conduit with wall

Self-Check -5

Written Test

- 1----- is used change direction of conduit in installation
 - a. Saddle b. elbow c. junction box d.nipple
2. Which is used to for securing conduit in place prior to covering with plaster?
 - a. Crumpet b. clip c. socket d. elbow
3. The purpose of junction box in the installation is -----
 - a. Distribution b . inspection c . maintenance d.all



Information Sheet-6

cutting required conduit length

Length

A ruler or rule is a tool used in, for example, geometry, technical drawing, engineering, and carpentry, to measure lengths or distances or to draw straight lines. Strictly speaking, the *ruler* is the instrument used to **rule** straight lines and the calibrated instrument used for determining length is called a *measure*, however common usage calls tape rule used for an unmarked rule. The use of the word *measure*, in the sense of a measuring instrument, only survives in the phrase *tape measure*, an instrument that can be used to measure but cannot be used to draw straight lines.

Steel rule

It is one of the most basic but most important measuring tools. The common lengths are 150 mm, 300 mm and 500 mm. Metric rules are graduated in millimeters (mm) and centimeters (Cm). When using the rule, take measurements from a datum side or surface, as shown in Figure 4.46. Hold the edge so that the graduations are in contact with the surface of the object that you are measuring. If the rule is lying on the flat side there might be an error in the reading. Be careful to protect the ends of the rule from damage. Any misuse may render it ineffective as a measuring tool.

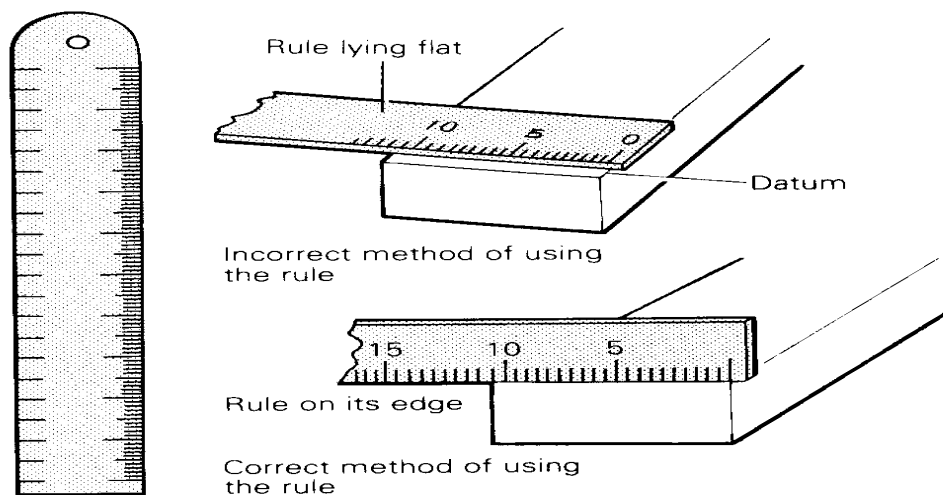


Figure 4.46 The steel rule.

Tape Rule (Pocket or flexible)

Pocket or flexible rules have blades made of flexible steel, which are spring-loaded into a case. They are longer than steel rules and can therefore be used to measure much greater lengths (typically up to 5 m). They are portable, and can be carried about in the pocket. It is difficult to take accurate readings with a rule, because you have to estimate measurements



Self-Check -5

Written Test

1. Write tools used to measure distance

1.

2.

Operation Sheet-1

Techniques of conduit bending

Methods to bend pvc conduit 90 degree

1. Identify the type of rigid and/or conduit
2. Measure the required length.
3. Cut the required length using hacksaw or pip cutter
4. connect the electric stove to power supply
5. apply enough heat to the conduit if pvc and insert to the bender if it is metallic conduit.
6. Bend the conduit at right angle
7. Check the bent at right angle
8. Report your work and conclusion to your trainer



INSTALLATION CONSTRUCTION WORKS Level - I

Learning Guide –13

Unit of Competence Perform Roughing-In Activities for Communication
and Distribution Systems

Module Title Performing Roughing-In Activities for Communication and
Distribution Systems

LG Code: CON ICW1 M13 LO2-LG-13

TTLM Code: CON ICW1 TTLM 05 19v1

LO No 2:- Install wire ways and cable tray



Instruction Sheet	Learning Guide #-
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This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- ❖ Selecting quantities of materials
- ❖ Selecting tools and equipment
- ❖ Installing Wire ways and cable trays
- ❖ Applying Safety procedure.

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- ❖ Select quantities of materials
- ❖ Select tools and equipment
- ❖ Install Wire ways and cable trays
- ❖ Apply Safety procedure.

Learning Instructions:

8. Read the specific objectives of this Learning Guide.
9. Follow the instructions described in number 3 to 20.
10. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask your teacher for assistance if you have hard time understanding them.
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Information Sheet-1

Select quantities of materials

Materials

Materials are those consumable things used at once in the installation but cannot be used in the other installations repeatedly

For any electrical work the correct drawing of that project may be prepared and that drawing should correctly interpreted to perform that work. Based on the drawing a worker can select or determine the quantity and type of materials used in the project.

The quantity/amount of materials depends on;-

- Size of project
- Purpose of the project
- The drawing of the project
- The need of the client (especially electrical)

To determine the quantity and type of materials for any given installation,

1. Read and interpret the given drawing correctly
2. Understand the electrical symbols used in the drawing
3. Determine the exact length of each materials needed on the project
4. Determine the type of required materials
5. Select the exact amount of required materials for the project

The selected material must be with the accordance specification listed/stated in the drawing

Self-Check -1

Written Test

1. Which is used to purchase quality of materials?
a. Specification b. quantity c. color d. size
2. What determines the amount of required materials?
a. size of project b. purpose of the project c. client interest d. all



Information Sheet-2

Tools and equipment

TOOLS

For any performance and good quality of work, it is always preferred to have standard tools. Most accidents occur due to the use of cheap and blunt tools. It is always necessary to take proper care and maintenance of tools. Each tool has definite purpose. So “**USE THE RIGHT TOOL FOR THE RIGHT PURPOSE**”

Equipment

- ❖ Equipment most commonly refers to a set of tools or other objects commonly used to achieve a particular objective. Different jobs require different kinds of equipment.^[1]
- ❖ Electrical equipment includes any machine powered by electricity. It usually consists of an enclosure, a variety of electrical components, and often a power switch. Examples of these include:

- Major appliance
- Microcontroller
- Programmable logic controller
- Small appliances
- ❖ More specifically, often electrical equipment refers only to components part of the electrical distribution system such as:
 - Electric switchboards
 - Distribution boards
 - Circuit breakers and disconnects
 - Electricity meter

Equipment is an electrical device used to bend , cut, and tread different conduits for installation. The followings are some of the tools and equipment used for this task.

Spirit level, hack saw, pipe cutter, plumb bob, pipe reamer, pipe threaded, pipe bender, bolt cutter for metallic conduit and pliers, screwdrivers, hammers, electric drill etc are also used for installing conduit, wire and cables



Self-Check -2

Written Test

Write the purpose of the following tools and equipment

- 1.pipe bender
- 2.pliers
- 3.sprit level
- 4.electric drill
- 5.screw driver

Information Sheet-3

Install Wire ways and cable trays


3.1 Wire way

A wire way is typically produced as a metallic or non-metallic trough with hinged or removable covers, so that the cables contained are well-protected but still accessible. The high cost of manufacturing and installing wire ways limits their use to small sections of cable management systems, while most systems primarily consist of cable trays, conduit, and other types of raceway. When connected, wire ways must be reinforced using special fittings and gaskets between sections.



Wire ways are designed to protect cables from environmental contaminants such as dust, dirt, oil, and moisture. Wire ways—sometimes known as "troughs" or "gutters" within the electrical contracting field—are commonly used to control wiring in environments where contaminants may cause problems. Depending on the product type, they can be mounted to walls or ceilings, secured under flooring, or laid out in a hybrid design in unique cable management systems.

Types

Wire ways are produced in three different forms, as shown in the table below.

Type	Description	Image
Lay-in	One side of trough opens via hinges; wires may be laid in instead of pulled through.	



<p>Pull-through</p>	<p>Wires or cables must be strung through trough; may still have a hinged lid to allow cable access.</p>	
<p>Cable trough</p>	<p>Simple trough with no cover.</p>	

Standards and Applications

Because they are frequently used in hazardous environments, the use of wire ways is governed by several important standards and approval ratings. These ratings help determine a wire way's appropriateness for a specific application or environment

3.2 cable tray

In the electrical wiring of buildings, a **cable tray** system is used to support insulated electric cables used for power distribution and communication. Cable trays are used as an alternative to open wiring or electrical conduit systems, and are commonly used for cable management in commercial and industrial construction. They are especially useful in situations where changes to a wiring system are anticipated, since new cables can be installed by laying them in the tray, instead of pulling them through a pipe.

Several types of tray are used in different applications. A solid-bottom tray provides the maximum protection to cables, but requires cutting the tray or using fittings to enter or exit cables. A deep, solid enclosure for cables is called a cable channel or cable trough.

A ventilated tray has openings in the bottom of the tray, allowing some air circulation around the cables, water drainage, and allowing some dust to fall through the tray. Small cables may exit the tray through the ventilation openings, which may be either slots or holes punched in the bottom. A ladder tray has the cables supported by a traverse bar, similarly to the rungs of a ladder, at regular intervals on the order of 4 to 12 inches (100 to 300 mm).

Ladder and ventilated trays may have solid covers to protect cables from falling objects, dust, and water. Tray covers for use outdoors or in dusty locations may have a peaked shape to shed debris including dust, ice or snow. Lighter cable trays are more appropriate in situations where a great number of small cables are used, such as for telephone or computer network cables. These trays may be made of wire mesh, called "cable basket" or be designed in the form of a single central spine (rail) with ribs to support the cable on either side.

Large power cables laid in the tray may require support blocks to maintain spacing between conductors, to prevent overheating of the wires. Smaller cables may be laid unsecured in horizontal trays, or secured with cable ties to the bottom of vertically mounted trays.



To maintain support of cables at changes of elevation or direction of a tray, a large number of specialized cable tray fittings are made compatible with each style and manufacturer. Horizontal elbows change direction of a tray in the same plane as the bottom of the tray and are made in 30, 45 and 90 degree forms; inside and outside elbows are for changes perpendicular to the tray bottom. These can be in various shapes including tees and crosses. Some manufacturers and types provide adjustable elbows, useful for field-fitting a tray around obstacles or around irregular shapes.

Various clamping, supporting and splicing accessories are used with the cable tray to provide a complete functional tray system. For example, different sizes of cable tray used within one run can be connected with reducers.

Self-Check -3	Written Test
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What is the purpose of cable tray?

What is wire way?

Information Sheet-4	Apply Safety procedure.
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Safety

Everyone has a duty of care under the Health and Safety at Work Laws and Regulations to take care of themselves and others who may be affected by their work activities.

In general terms the employer/trainer must put adequate health and safety systems in place at work and an employee (worker)/trainer must use all safety systems and procedures responsibly. In more specific terms, there are actions that must take to comply with the Health and Safety Laws.

- make the workplace safe and without risk to health
- provide adequate information, instruction, training and supervision
- Wear any protective clothing or equipment (PPE) required
- report certain injuries, diseases and dangerous occurrences
- provide adequate first aid facilities
- ensure that tools, equipment and machinery are safe and that safe systems and procedures of work are put in place and followed
- ensure that articles and substances are moved, stored and used safely
- Clean dust
- .take reasonable care of their own health and safety of others
- co-operate with your friends on all matters relating to health and safety issues
- not interfere with, or mis-use others



Self-Check -4

Written Test

List at least 5 health and safety laws

- 1;
- 2.
- 3
- 4
- 5.



INSTALLATION CONSTRUCTION WORKS Level - I

Learning Guide –13

Unit of Competence Perform Roughing-In Activities for Communication and Distribution Systems

Module Title Performing Roughing-In Activities for Communication and Distribution Systems

LG Code: CON ICW1 M13 LO3-LG-13

TTLM Code: CON ICW1 TTLM 05 19v1

LO No 3:- . Install telephone terminal cabinet and distribution frame



Instruction Sheet	Learning Guide #-
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This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- ❖ Interpreting correct drawings
- ❖ selecting quantities of materials
- ❖ Selecting tools and equipment
- ❖ Installing telephone terminal cabinet
- ❖ Installing telephone main distribution
- ❖ Following Safety procedures

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- ❖ Interpret correct drawings
- ❖ select quantities of materials
- ❖ Select tools and equipment
- ❖ Install telephone terminal cabinet
- ❖ Install telephone main distribution
- ❖ Follow Safety procedures

Learning Instructions:

15. Read the specific objectives of this Learning Guide.
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Information Sheet-1

Install telephone terminal cabinet

1 Telephone terminal cabinet

Telephone terminal-cabinet. ... The **Cabinet**, according to the country Electrical Code must have doors and are thus distinguished from large boxes with covers consisting of plates attached with screws and bolts



1.2 Distribution frame

A **Main Distribution Frame (MDF)** is a signal **distribution frame** or cable rack used in telephony to interconnect and manage telecommunication wiring between itself and any number of **intermediate distribution frames** and cabling from the telephony network it supports.

In [telecommunications](#), a **distribution frame** is a passive device which terminates cables, allowing arbitrary interconnections to be made.

For example, the [Main Distribution Frame \(MDF\)](#) located at a [telephone central office](#) terminates the cables leading to [subscribers](#) on the one hand, and cables leading to active equipment (such as [DSLAMs](#) and [telephone switches](#)) on the other. Service is



provided to a [subscriber](#) by manually wiring a [twisted pair](#) (called a jumper wire) between the [telephone line](#) and the relevant [DSL](#) or [POTS](#) line circuit.

In [broadcast engineering](#), a **distribution frame** is a location within an apparatus room through which all [signals](#) ([audio](#), [video](#), or [data](#)) pass, with the ability to arbitrarily route and connect sources and destinations between [studios](#) and other internal and external points. Connections can either be [soldered](#), or made using [terminal blocks](#). Because the frame may carry live broadcast signals, it may be considered part of the [airchain](#).

The MDF is a termination point within the local [telephone exchange](#) where exchange equipment and terminations of [local loops](#) are connected by jumper wires at the MDF. All cable copper pairs supplying services through [user telephone lines](#) are terminated at the MDF and distributed through the MDF to equipment within the local exchange e.g. [repeaters](#) and [DSLAM](#). Cables to [intermediate distribution frames](#) (IDF) terminate at the MDF. [Trunk](#) cables may terminate on the same MDF or on a separate trunk main distribution frame (TMDF).

Like other [distribution frames](#) the MDF provides flexibility in assigning facilities, at lower cost and higher capacity than a [patch panel](#).



Self-Check -1

Written Test

1. Which is true about telephone cabinet ? :---

a. large box b..consist of plates attached with screws and bolts c. Terminal box d. all

2. A termination point within the local telephone exchange where exchange equipment and terminations of local loops are connected a. Telephone cabinet b. Distribution frame c. wire way d. Bridge



Operation Sheet-2	Techniques of Installing wire ways, and MDB in conduits
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Methods to Installing wire ways, and MDB in conduits

1. prepare the ckt board 120m x120m
2. Identify the type of rigid conduit
3. Measure the required length.
4. Cut the required length using hacksaw
5. install the junction boxes
6. install the conduit
7. fix the conduit accessories at required place
8. Install wire ways, MDB and telephone terminals
9. measure the dimension to check its correctness
10. Report your work and conclusion to your trainer

List of Reference Materials



INSTALLATION CONSTRUCTION WORKS Level - I

Learning Guide –13

Unit of Competence Perform Roughing-In Activities for Communication
and Distribution Systems

Module Title Performing Roughing-In Activities for Communication and
Distribution Systems

LG Code: CON ICW1 M13 LO3-LG-13

TTLM Code: CON ICW1 TTLM 04 19v1

LO No 4:- Install cable bridge



Instruction Sheet	Learning Guide #-
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This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- ❖ Interpreting correct drawings
- ❖ selecting correct quantities of materials
- ❖ Selecting tools and equipment
- ❖ Installing cable bridge power tools
- ❖ Following Safety procedures

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- ❖ Interpret correct drawings
- ❖ select correct quantities of materials
- ❖ Select tools and equipment
- ❖ Install cable bridge power tools
- ❖ Follow Safety procedures

Learning Instructions:

22. Read the specific objectives of this Learning Guide.
23. Follow the instructions described in number 3 to 20.
24. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask your teacher for assistance if you have hard time understanding them.
25. Accomplish the “Self-check 1” **in page -**.
26. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
27. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
28. Submit your accomplished Self-check. This will form part of your training portfolio.



4.1 Cable Bridge

The **Cable Bridge**, officially called the **Ed Hendler Bridge** and sometimes called the **Intercity Bridge**

A **cable-stayed bridge** has one or more *towers* (or *pylons*), from which cables support the bridge deck. A distinctive feature are the cables or stays, which run directly from the tower to the deck, normally forming a fan-like pattern or a series of parallel lines. This is in contrast to the modern suspension bridge, where the cables supporting the deck are suspended vertically from the main cable, anchored at both ends of the bridge and running between the towers. The cable-stayed bridge is optimal for spans longer than cantilever bridges and shorter than suspension bridges. This is the range within which cantilever bridges would rapidly grow heavier, and suspension bridge cabling would be more costly.

The Cable Bridge, from the time of its opening, has proved to be a popular landmark in the Tri-City area, so much so it has become an unofficial symbol of the area. Every winter, an event known as the Lampson Cable Bridge Run, including mile, five-kilometer, and 10-kilometer foot races, starts at the Kennewick end of the bridge near the Lampson International headquarters. All three share the same starting line. The five- and 10-kilometer events share an indoor finish line at the Lampson Maintenance Shop, while the 1-mile has its own outdoor finish.

A **cable-stayed bridge** has one or more *towers* (or *pylons*), from which cables support the bridge deck.

There are two major classes of cable-stayed bridges: *harp* and *fan*.

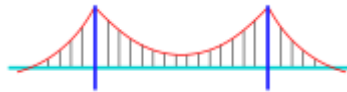
In the *harp* or *parallel* design, the cables are nearly parallel so that the height of their attachment to the tower is proportional to the distance from the tower to their mounting on the deck.

In the *fan* design, the cables all connect to or pass over the top of the towers. The fan design is structurally superior with minimum moment applied to the towers but for practical reasons the modified fan is preferred especially where many cables are necessary. In the modified fan arrangement the cables terminate near to the top of the tower but are spaced from each other sufficiently to allow better termination, improved environmental protection, and good access to individual cables for maintenance.

In suspension bridges, large main cables (normally 2) hang between the towers (normally 2), and are anchored at each end to the ground. This can be difficult to implement when ground conditions are poor. The main cables, which are free to move on bearings in the towers, bear the load of the bridge deck. Before the deck is installed, the cables are under tension from their own weight. Along the main cables smaller cables or rods connect to the bridge deck, which is lifted in sections. As this is done, the tension in the cables increases, as it does with the live load of traffic crossing the bridge. The tension on the main cables is transferred to the ground at the anchorages and by downwards tug on the towers.



- Difference between types of bridges



• Suspension bridge



• Cable-stayed bridge, fan design



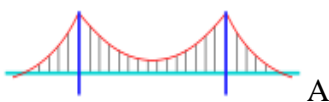
• Cable-stayed bridge, harp design

In the cable-stayed bridge, the towers are the primary load-bearing structures which transmit the bridge loads to the ground. A cantilever approach is often used to support the bridge deck near the towers, but lengths further from them are supported by cables running directly to the towers. This has the disadvantage, compared to the suspension bridge, that the cables pull to the sides as opposed to directly up, requiring the bridge deck to be stronger to resist the resulting horizontal compression loads; but has the advantage of not requiring firm anchorages to resist the horizontal pull of the main cables of the suspension bridge. By design all static horizontal forces of the cable-stayed bridge are balanced so that the supporting towers do not tend to tilt or slide, needing only to resist horizontal forces from the live loads.

Key advantages of the cable-stayed form are as follows:

- much greater stiffness than the suspension bridge, so that deformations of the deck under live loads are reduced
- can be constructed by cantilevering out from the tower - the cables act both as temporary and permanent supports to the bridge deck
- for a symmetrical bridge (i.e. spans on either side of the tower are the same), the horizontal forces balance and large ground anchorages are not required

Self-Check -1	Written Test
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-----1 Cable-stayed bridge, harp design



-----2. Suspension bridge



-----3. Cable-stayed bridge, fan design



INSTALLATION CONSTRUCTION WORKS Level - I

Learning Guide –13

Unit of Competence Perform Roughing-In Activities for Communication and Distribution Systems

Module Title Performing Roughing-In Activities for Communication and Distribution Systems

LG Code: CON ICW1 M13 LO5-LG-13

TTLM Code: CON ICW1 TTLM 05 19v1

LO No 5:- Notify completion of work



Instruction Sheet	Learning Guide #-
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This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- ❖ Making final checks
- ❖ Notifying completion of work
- ❖ Cleaning, checking and returning tools and equipment
- ❖ Cleaning work area

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- ❖ Make final checks
- ❖ Notify completion of work
- ❖ Clean, check and return tools and equipment
- ❖ Clean work area

Learning Instructions:

29. Read the specific objectives of this Learning Guide.
30. Follow the instructions described in number 3 to 20.
31. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask your teacher for assistance if you have hard time understanding them.
32. Accomplish the “Self-check 1” **in page -.**
33. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
34. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
35. Submit your accomplished Self-check. This will form part of your training portfolio.



5.1 Inspection

IEE Section 712 lists the areas of the installation which must be inspected and this should be carried out before the testing work is started. The inspection can of course be undertaken during the erection of the equipment, and in some cases this is the only practical way of carrying out this work. The person carrying out the inspection and testing work will need to have an understanding of the design concept used in the installation, and will thus need to have available the data from the design phase relating to the assessment of general characteristics. It is also necessary to have available charts or diagrams showing the arrangements of each circuit, items which should be covered by the inspection work, and these include:

electrical connections identification of conductors safe routing of cables conductors are selected in accordance with the design that single pole devices are connected in the phase conductor correct connection of sockets, accessories and equipment presence appropriate isolators and switches methods of protection against electric shock prevention of mutual detrimental influence undervoltage protection danger notices and labelling of circuits, fuses, etc. access to switchgear is adequate. Special attention should be paid to flexible cords which are connected to portable appliances, especially where they enter plugs and appliances. In old installations the insulation of cables where they enter distribution boards and switchfuses should be carefully examined, as very often the insulation becomes damaged and brittle due to heat. All protective devices and fuselinks should be checked to ensure they are of the correct rating to protect the circuit cables which they control

TESTING

IEE Regulations 713-02 to 713-12 detail the standard methods of testing required. The tests should be as follows, and should be carried out in the sequence indicated: continuity of protective conductors continuity of final circuit ring conductors insulation resistance insulation of site-built assemblies protection by separation of circuits protection by barriers or enclosures insulation of non-conducting floors and walls polarity earth electrode resistance earth fault loop impedance prospective fault current functional tests including the operation of residual current devices. The methods of making these tests are detailed in IEE Chapter 71. The Health and Safety Executive has issued a guide on Electrical Testing (HS(G) 13 HMSO) which gives advice on precautions which should be taken when testing live installations. The guide mentions that many accidents occur when making these tests. It recommends that bare ends of test probes should not exceed 2 to 3 mm of bare metal, and that metal lampholders should never be used for test lamps. Some hints, based upon practical experience, are given here to supplement the advice contained in the Regulation

5.2 . NOTIFICATION

Is Inform or report somebody officially about completion of work

A confirmation letter is a formal document that summarizes the verbal agreement made between two parties. This type of letter is commonly used by businesses to record and acknowledge specific tasks. ... A letter of confirmation is also sent out by an employer to appoint a new employee.



Confirming Attendance letter. It is polite to write to confirm your attendance to an event so that people are aware. Writing an attendance letter can be of two, one writing by the person attending and the other written by the person inviting the person to attend, but both are similar since they both confirm attendance.

LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 30 min.

Task 1. Measure and mark the required length

Task 2. Connect the boxes with 16mm rigid conduit

