Electrical Workshop

Module 2: Hand Tools

PREPARED BY

Academic Services Unit

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Module Objectives

Upon successful completion of this module, students should be able to:

1. Identify different hand tools used in workshops.
2. Familiarize with the different types and functions of hand tools.
3. Familiarize with the workshop tools and safety rules.

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2.1 Introduction:
Hand tools are important equipments that help us to do our work effectively and quickly. Regardless of your position in life, you will need to use hand tools to repair your home or to fix your bicycle. Figure 2.1 shows some hand tools applications. Therefore, everyone should have a basic knowledge of the available hand tools, their usage and maintenance. In this module, you will be introduced to basic hand tools, their types, usage and safety.

Figure 2.1: Hand tool applications
2.2 Common tools:

1. Screwdrivers:
   - **Purpose:** The screwdriver is a tool used to *insert and tighten* or to *loosen and remove* screws. Figure 2.2 illustrates the purpose of the screwdriver.

   ![Insert and tighten screws](image1)
   ![Loosen and remove screws](image2)

   **Figure 2.2: Purpose of screwdrivers**

   - **Types:** The shape of their head into different types identifies screwdrivers. Figure 2.3 shows different types of screwdrivers, their head shape and symbols.

<table>
<thead>
<tr>
<th>Screwdriver type</th>
<th>Head symbol</th>
<th>Head shape</th>
<th>screws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot-head</td>
<td><img src="image3" alt="Slot-head symbol" /></td>
<td><img src="image4" alt="Slot-head shape" /></td>
<td><img src="image5" alt="Slot-head screw" /></td>
</tr>
<tr>
<td>Phillips</td>
<td><img src="image6" alt="Phillips symbol" /></td>
<td><img src="image7" alt="Phillips shape" /></td>
<td><img src="image8" alt="Phillips screw" /></td>
</tr>
<tr>
<td>Torx</td>
<td><img src="image9" alt="Torx symbol" /></td>
<td><img src="image10" alt="Torx shape" /></td>
<td><img src="image11" alt="Torx screw" /></td>
</tr>
<tr>
<td>Allen Keys</td>
<td><img src="image12" alt="Allen Keys symbol" /></td>
<td><img src="image13" alt="Allen Keys shape" /></td>
<td><img src="image14" alt="Allen Keys screw" /></td>
</tr>
</tbody>
</table>

   **Figure 2.3: Screw driver types**
2. **Wire strippers:**

- **Purpose:** Wire strippers are small, hand-held devices used to strip the insulation from electric wires. Figure 2.4 illustrates the purpose of wire strippers.

![Before Stripping](image1) ![After Stripping](image2)

**Figure 2.4: Purpose of wire strippers**

- **Types:** Wire strippers are classified into two types: manual and automatic.

![Wire strippers types](image3)

**Figure 2.5: Types of wire strippers**
3. Side Cutters:

- **Purpose:** The side cutters are used for cutting extra components leads. Figure 2.6 illustrates the purpose of side cutters.

![Cutting extra components leads](image)

*Figure 2.6: Purpose of side cutters*

4. Wire Crimpers:

- **Purpose:** Wire Crimpers are used to connect two wires or two conductors together. Figure 2.7 shows wire crimpers.

![Wire crimpers](image)

*Figure 2.7: wire crimpers*
2.3 Hand Tools Safety:

1. Basic Rules for hand tools Safety:

To prevent accidents that are caused by hand tools, follow the coming tips:

<table>
<thead>
<tr>
<th>Always use the appropriate personal protective devices and check that they are clean and in good repair before and after use.</th>
<th>Always report injuries, accidents or damaged tools to the instructor to insure safety of others.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always keep the tool pointed away from you</td>
<td>Don't carry tools in your pockets</td>
</tr>
</tbody>
</table>
### 2.4 Class and Lab Activities:
- Activity 1: Indicate the safe and unsafe behavior in the following pictures. Give Reasons

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Safe</th>
<th>Not safe</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image of safe behavior]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Image of unsafe behavior]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity 2: Take the students to the workshop and introduce them to the different hand tools that are studied in this module. Fill in the table below:

<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Purpose</th>
<th>Type if any</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td><img src="image1.png" alt="Screwdriver" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><img src="image2.png" alt="Pliers" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><img src="image3.png" alt=" Wire Stripper " /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><img src="image4.png" alt="Crimp Tool" /></td>
</tr>
</tbody>
</table>
Activity 3: How to use wire strippers

- Items Required:

<table>
<thead>
<tr>
<th>Wire stripper</th>
<th>Wires</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Wire stripper" /></td>
<td><img src="image2.png" alt="Wires" /></td>
</tr>
</tbody>
</table>

- Steps:

1. Hold the wire stripper in your hand
2. Put the wire that you want to remove the insulation from into the jaws of wire stripper up to the length you need
3. Squeeze the handle. The jaw will remove the wire insulation.
4. Once you finish squeezing the handle, release the handle and the jaw will open again. See Figure 2.8

![Wire Stripper](image3.png)

Figure 2.8: How to use a wire stripper

5. Now, the insulation of the wire is removed.
Activity 4: How to use a wire crimper to crimp pins

- Items Required:

<table>
<thead>
<tr>
<th>Stripped wire (from activity 3)</th>
<th>Crimp Pins (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Stripped wire" /></td>
<td><img src="image" alt="Crimp Pins" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wire crimper</th>
<th>0.1 Inch Crimp Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Wire crimper" /></td>
<td><img src="image" alt="0.1 Inch Crimp Housing" /></td>
</tr>
</tbody>
</table>

- Steps:

1. Bend off a pin from the strip

2. There are two clamps in the crimp pin: one to clamp the wire, and one to support and clamp the insulation. Insert the stripped wire into the crimp pin as shown in the picture above.

3. Place the crimp into the crimper as shown in the figure above

4. Squeeze and insert into housing
Activity 5: How to wire a 3-pin plug.

- **Items Required:**

<table>
<thead>
<tr>
<th>Power Cables</th>
<th>Screw Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Power Cables" /></td>
<td><img src="image2.png" alt="Screw Driver" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knife Or Cutter</th>
<th>Wire Stripper</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Knife Or Cutter" /></td>
<td><img src="image4.png" alt="Wire Stripper" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 Pin Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5.png" alt="3 Pin Plug" /></td>
</tr>
</tbody>
</table>

- **Steps:**

1. Use a medium-sized screwdriver to remove the screw in the centre of the plug. Some plugs have two smaller screws that hold a clamp across the wire. This clamp used to stop the wire cord from being pulled out by the plug. Loosen these screws.

2. Remove the plug’s top cover but ensure none of the pins or the fuse falls out.

3. After opening the plug, lay the cable along the plug to get the required length of outer covering that needs removing as shown below.
4. Carefully, using a knife, cut round the outer cover taking care not to cut the inner cores as shown below.

5. Remove the cable clamp and place the outer covering under the clamp and tighten as shown below

6. Place the cores into their correct positions as shown below

<table>
<thead>
<tr>
<th>Core color</th>
<th>Core marking</th>
<th>Core position</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROWN</td>
<td>Live (L)</td>
<td>FUSE (RIGHT HAND PIN)</td>
</tr>
<tr>
<td>BLUE</td>
<td>Neutral (N)</td>
<td>LEFT HAND PIN</td>
</tr>
<tr>
<td>GREEN/YELLOW</td>
<td>Earth (E)</td>
<td>EARTH PIN (TOP)</td>
</tr>
</tbody>
</table>
7. Cut the cores to the required length then strip the insulation back 5-6 mm and connect up making sure that there are NO stray strands as shown below.

8. Replace the top and screw the top of the plug back on as shown below. Now your three-pin plug is ready to be used.
Review Exercise

Exercise 1: Choose the correct answer:

1. The screw driver type for the head symbol shown below is:
   a. Slot-head
   b. Torx
   c. Philips
   d. Allen Key

2. The screw driver type for the head symbol shown below is:
   a. Slot-head
   b. Torx
   c. Philips
   d. Allen Key

3. The tool shown in the following figure is:
   a. Automatic wire-stripper
   b. Manual wire-stripper
   c. Automatic side cutter
   d. Manual side cutter

4. If you want to remove the insulation from a wire you will use a:
   a. Side cutter
   b. Wire stripper
   c. Screw driver
   d. Crimper tool

5. If you want to loosen a screw you will need a:
   a. Side cutter
   b. Wire stripper
   c. Screw driver
   d. Crimper tool

6. If you want to connect two conductors together you need a:
   a. Side cutter
   b. Wire stripper
   c. Screw driver
   d. Crimper tool
7. The tool shown in the following figure is:
   a. Wire-stripper
   b. Side cutter
   c. Screw driver
   d. Crimper tool

8. If you want to cut or remove an extra lead you need:
   a. Side cutter
   b. Wire stripper
   c. Screw driver
   d. Crimper tool

Exercise 2: Indicate if the following sentences are true or false:

1) You have to use a holder to fix the working tool, so that tool will be pointed away from your hand. ( )
2) In order to protect your hand while using hand tools you can wear protected gloves. ( )
3) You can use a screwdriver with a loose handle, which may cause your hand to slip. ( )
4) Cutting tools should be kept sharp to ensure good smooth cutting. ( )
5) Always wear the PPE required for the job. Protect your eyes, hands, ears and other body parts. ( )

Exercise 3: Identify and label the live, neutral and earth wires.