4330203_AEES_UNIT_1

Relevance/Objective:

- To identify various fuse used in vehicle.
- To know specification various fuse.

Learning Outcome:

- Students will be able to identify various fuse used in vehicle as per specification.

Relevant CO:

- Explain basic electrical principles, construction and working of various electrical auxiliaries systems.

Introduction:

In general terms, a fuse is a safety electrical device that is used to protect an electrical circuit from overcurrent. It's mounted to various electrical circuits since overcurrent conditions happen at an unexpected time. The system works as a circuit breaker or stabilizer that also protects devices from damages. However, a thin strip or strand is used in this situation.

In an automobile vehicle, fuses perform the same task. They can be mounted in fuse blocks, inline fuse holders, or fuse clips. Although some automotive fuses are occasion-ally used in non-automotive electrical applications.

Components of automotive fuses contain a thin strip or strand of metal. But because there are many types available with different working capacity their material may be quite different. Furthermore, automotive fuses are extensively used in cars, trucks, buses, and off-road transportation. The purpose is to protect the cables, wires, and electrical components of the vehicle that supply power to crucial electrical parts like lights, heaters, air conditioning, radios, power windows, and many others.

Types of Automotive fuses:

Automotive fuses can be classified into four distinct categories:

· Blade fuses

· Bosch types

· Glass tube

Blade fuses:

Blade fuses (also called spade or plug-in fuses), with a plastic body and two prongs that fit into sockets, are mostly used in automobiles. Other common usage is in equipment with comparatively simple, low voltage DC electrical systems such as towed campers and marine applications such as sailboats and motor boats (typically smaller cabin cruisers).Each fuse is printed with the rated current in amperes on the top.

These types of fuses come in six different physical dimensions:

1. Micro2.
2. Micro3.
3. LP-mini (APS), also known as low-profile mini. Unofficially, the "low-profile mini" fuse is sometimes incorrectly called "Micro" since the term means smaller than mini, but recently fuses using the Micro name have been released.
4. Mini (APM / ATM). The mini fuses were developed in the 1990s.
5. Regular (APR / ATC / ATO / ATS) blade-type fuses, also known as standard, were developed in 1976 as ATO by little fuse for low voltage use in motor vehicles. Bussmann makes the ATC that also complies with the same ISO 8820-3 and SAE J1284 standards. OptiFuse, a newer entrant in the market, makes regular (APR / ATC / ATO) fuses that meet the same standards.
6. Maxi (APX), heavy-duty.

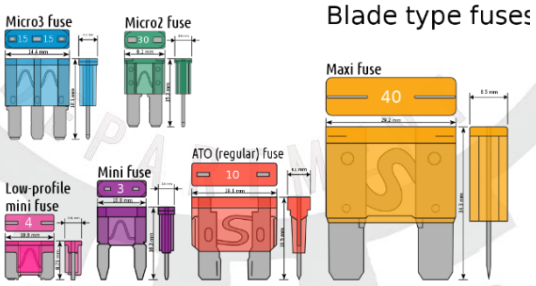


Figure : Various type of fuse used in vehicle

Size groups:

Blade size	Blade group	Dimensions L × W × H	Common ratings (maximum current)

Micro2	APT, ATR	9.1 × 3.8 × 15.3 mm	5, 7.5, 10, 15, 20, 25, 30
Micro3	ATL	14.4 × 4.2 × 18.1 mm	5, 7.5, 10, 15
LP-Mini (low profile)	APS, ATT	10.9 × 3.81 × 8.73 mm	2, 3, 4, 5, 7.5, 10, 15, 20, 25, 30
Mini	APM, ATM	10.9 × 3.6 × 16.3 mm	2, 3, 4, 5, 7.5, 10, 15, 20, 25, 30
Regular	APR, ATC, ATO, ATS	19.1 × 5.1 × 18.5 mm	0.5, 1, 2, 3, 4, 5, 7.5, 10, 15, 20, 25, 30, 35, 40
Maxi	APX	29.2 × 8.5 × 34.3 mm	20, 25, 30, 35, 40, 50, 60, 70, 80, 100, 120

Bosch Fuses:

Bosch fuses are commonly seen in old cars. The fuse types can be identified by the conical ends and the physical dimension size of 6x25mm. Bosch fuses are also known as 6AC, GBC or Torpedo fuses. Although, the ampere rating is denoted by the color of the fuse.

Figure : Bosch Fuse

Color coding:

Glass tube:

Color	Current rating
Yellow	5 A
White	8 A
Red	16 A
Blue	25 A
Grey	40 A

Automobile companies-built vehicles up to at least 1986 had electrical systems protected by cylindrical glass cartridge fuses rated 32 volts DC and current ratings from 4 amperes to 30 amperes. These are known as "SFE" fuses, as they were designed by the Society of Fuse Engineers to prevent the insertion of a grossly inadequate or unsafe fuse into the vehicle's fuse panel. These SFE fuses all have a 1⁄4 inch diameter, and the length varies according to the rating of the fuse.

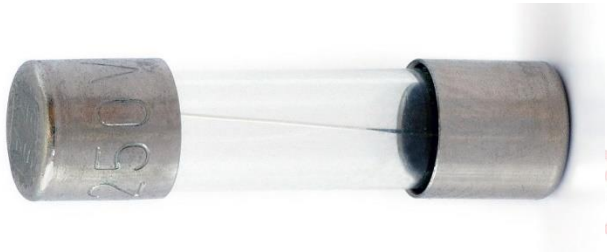


Figure : Glass tube type fuse

- A 4 A SFE 4 fuse is 5⁄8 inch long (the same dimension as an AGA fuse of any rating),
- A 6 A SFE 6 fuse is 3⁄4 inch long,
- A 7.5 A SFE 7.5 fuse is 7⁄8 inch long (same as an AGW fuse of any rating),
- A 9 A SFE 9 fuse is 7⁄8 inch long (same as an AGW fuse of any rating),
- A 14 A SFE 14 fuse is 11⁄16 inch long,
- A 20 A SFE 20 fuse is 1 1⁄4 inch long (same as an AGC fuse of any rating), and
- A 30 A SFE 30 fuse is 17⁄16 inches long

Observation:

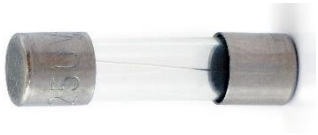
Prepare task sheet for mentioned practical.

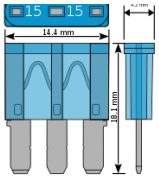
Assignment Questions

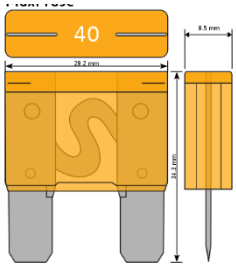
1. What is function of fuse in vehicle?

2. Write the types of fuses used in vehicle.

3. Identify the fuse given in the image:







a) _____ b) _____ c) _____

The electrical systems are electrically controlled devices in a vehicle, they receive energy from the battery and return it back to the battery through the hearth. The charging system comprises of alternator and battery. This battery is used to power the starter motor helps the engine to start running while the alternator is used to charge the battery and other electrical components in the vehicle.

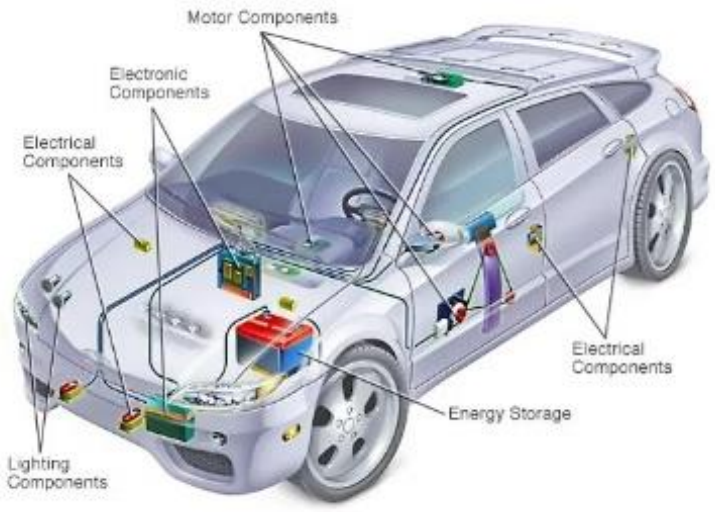


Figure : Diagram of a vehicle electrical system

The primary use of the electrical system is to power all electrical and electronic devices in a vehicle. starting from the electrical motor, sensors, gauges, heating element, headlights, brake and indicator lights, radio, television, air conditioning system, blowers, interior lights, refrigerator system, ignition system, etc. all these components receive power from a battery and the battery is charged by the alternator.

Ignition System:

An ignition system is a system used in vehicles, often petrol engine to ignite the fuel-air mixture. This ignition is purposely performed so that the explosion in the combustion chamber can be accomplished. The spark that occurs in the ignition system (spark plug) causes the fuel-air mixture to burn. The primary function of an ignition system is to create an electric spark in the engine combustion chamber at the proper time so that the petrol and air mixture can ignite.It produces approx. 20,000 volts across the spark plug. High spark voltage spark is supplied to each spark plug in the correct sequence. There is different spark timing with load, speed, and other conditions. The spark is timed so it can occur as the piston is approaching the top dead center.

Charging System:

The automobile charging system is a set of components working to keep a charge and provide electrical energy for the vehicle electrical devices. Modern vehicles are now designed with many electrical parts which makes them required a large amount of electrical energy. The charging system powers the headlights, dashboard indicators light or warning lamps, fuses, relays, engine plugs, brainbox, ECU, radio, control screen, fuel injector system, sensors etc. All these components are interconnected to the car battery which is charged by the alternator. The primary purpose of the charging system is to provide power to all electrical components in a vehicle. It comprises alternator that maintains and keep the vehicle's battery charged. Charging system help to send the engine mechanical issue to the engines ECU using a sensing device.

Task:

1. Draw the wiring diagram of battery Ignition system:

2. Draw the wiring diagram of charging system.

Assignment Questions

1. Write primary function vehicle electrical system?

2. Write function of vehicle ignition system.

3. Write function of vehicle charging system.

Introduction:

Electrical Auxiliary System is used to describe a collection of related automotive Electrical components that interact with the main car systems and components to support his functionality. Electrical Auxiliary Systems are components related with Security Systems, Comfort Systems, Lighting Systems and Information Systems which are very important to help the main system to perform according the specifications.

Security Systems consists of Central locking door system, locking door with distance command, Biometric system, Anti steel system. Comfort and Safety Systems are Windows control, Sun roof control, Windshield wiper and window cleaning and Control view mirrors. Lighting Systems have Front Lighting, Rear lighting, Compartment lighting and Signalization lighting.

Task:

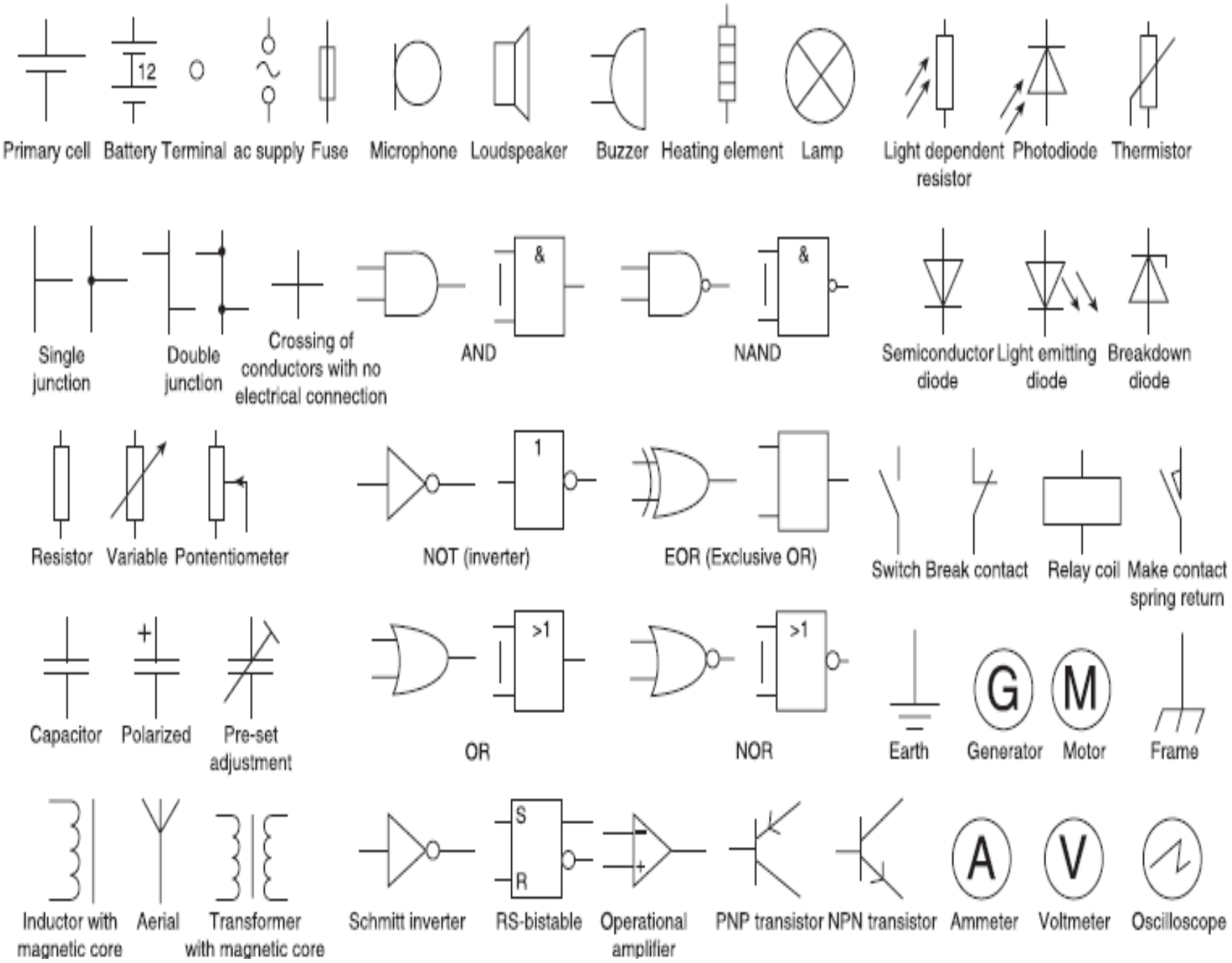
1. Draw the wiring diagram of lighting system:

2. Draw the wiring diagram of horn used in vehicle.

Assignment Questions

1. What are the different Auxiliary Systems in vehicle?

2. Enlist the different accessories used in vehicle.



Introduction:

Most automotive wire is made from strands of copper covered by plastic insulation. Copper is an excellent conductor of electricity that is reasonably priced and very flexible. However, solid copper wire can break when moved repeatedly; therefore, most copper wiring is constructed of multiple small strands that allow for repeated bending and moving without breaking. Such wire is called cable. Solid copper wire is generally used for components such as starter armature and alternator stator windings that do not bend or move during normal operation.

Size of wire:

Wiring is sized and purchased according to gauge size as assigned by the American wire gauge (AWG) system. As the gauge number increases, the size of the conductor wire decreases. Therefore, a 14-gauge wire is smaller than a 10-gauge wire. The greater the amount of current (in amperes) that is flowing through a wire, the larger the diameter (smaller gauge number) that will be required. Following are general applications for the most commonly used wire gauge sizes.

20 to 22 gauge: radio speaker wires

18 gauge: small bulbs and short leads

16 gauge: taillights, gas gauge, turn signals, windshield wipers

14 gauge: horn, radio power lead, headlights, cigarette lighter, brake lights

12 gauge: headlight switch to fuse box, rear window defogger, power windows and locks

10 gauge: alternator to battery

4, 2, or 0 (1/0) gauge: battery cables.

Colour coding:

In order to quickly identify and also to simplify the wiring system, the Cables are coloured. In addition, colour lines or threads are also used around the cables, which provide a very wide choice of colour combinations. The basic seven colour code system is the general one and it is as followed.

Brown: Battery circuit

Yellow: Charging circuit

White: Ignition circuit

Green: Auxiliary circuit

Blue: Headlamp circuit

Red: Side and tail lamp circuit

Black: Earth circuit

Electrical Symbols:

The service manuals of automotive manufacturers include wiring schematics of every electrical circuit in a vehicle. A wiring schematic, sometimes called a diagram, shows electrical components and wiring using symbols and lines to represent components and wires. A typical wiring schematic may include all of the circuits combined on several large foldout sheets, or they may be broken down to show individual circuits. So, it is very important to know electrical symbols used in wiring diagram. Following are few symbols that is used frequently in any automotive wiring diagram.

Wire joining Process:

Basic connections are to wiring what knots are to rope. These are any connection between two wires that do not rely on a special connector or tool to establish. These types of connections are fine for circuits with 5 amps or less flowing through them and for wiring of 16 -gauge or smaller.

Twisting and Taping:

- Grab two pieces of 18-gauge wire and strip 3/4 inch of insulation from the ends of each wire.
- Hold the two wires so that the bare wires cross at an angle.

- Twist the two wires tightly together in a clockwise direction.

- Bend the twisted connection into a U-shape.

- Lay the U-shape connection over one of the wires.

- Tightly insulate the connection with Super 33+ tape.

Crimping Non-Insulated Connectors

- Strip about 1/4 inch of the insulation off of the end of the wire.
- Twist the stripped end of the wire clockwise so that you can ensure that all strands of the wire can be inserted into the ferrule easily.

- Push the ring terminal over the end of the bare wire making sure that all of the wire is inside the ferrule—there should be at least 1/16 inch of wire sticking out the other end.

- Orient the crimp tool around the ring terminal so that the stake is opposite the seam.

- Squeeze the tool fully, thereby making the crimp.

- After crimping, grasp the connector and tug on it a little bit to be sure it's seated on the wire properly. If you didn't properly crimp it, it comes right off. This little check is good practice and is far better than having a connector come loose when you're driving down the road.

- **Crimping terminals:**

  Terminals can be crimped to create a good electrical connection if the proper type of crimping tool is used. Most vehicle manufacturers recommend that a W-shaped crimp be used to force the strands of the wire into a tight space. Notice that to create a good crimp the open part of the terminal is placed in the jaws of the crimping tool toward the anvil or the W-shape part.

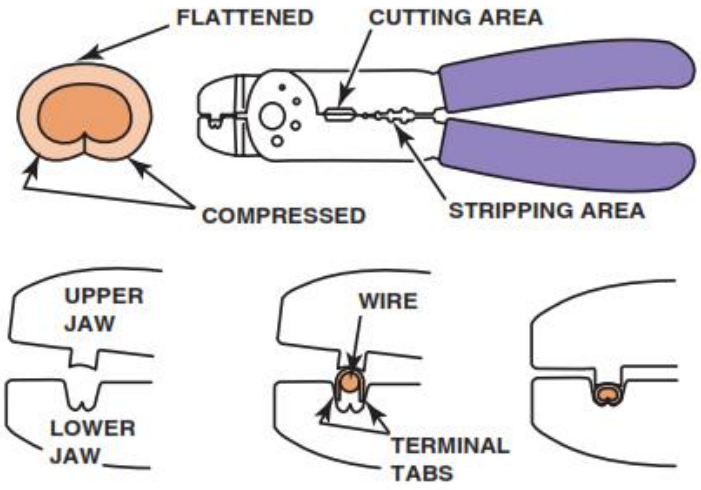


Figure : - W-shape Crimping Tool

- **Heat Shrink Tubing:**

Heat shrink tubing is usually made from polyvinyl chloride (PvC) or polyolefin and shrinks to about half of its original diameter when heated; this is usually called a 2:1 shrink ratio. Heat shrink by itself does not provide protection against corrosion, because the ends of the tubing are not sealed against moisture. Daimler Chrysler Corporation recommends that all wire repairs that may be exposed to the elements be repaired and sealed using adhesive-lined heat shrink tubing. The tubing is usually made from flame-retardant flexible polyolefin with an internal layer of special thermoplastic adhesive. When heated, this tubing shrinks to one-third of its original diameter (3:1 shrink ratio) and the adhesive melts and seals the ends of the tubing.

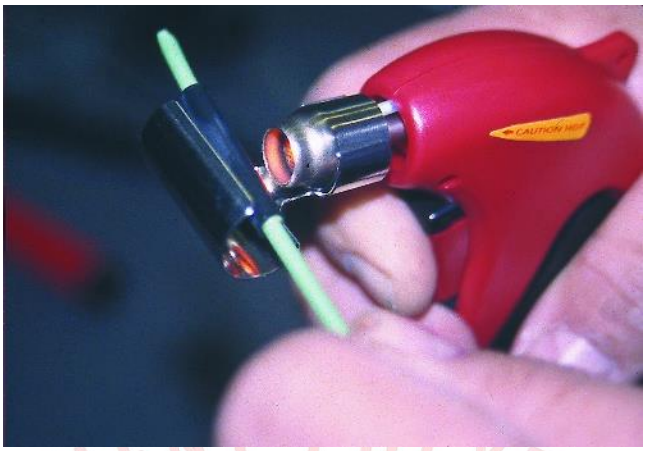


Figure : - Butane torch

- **Soldering Process:**

Many manufacturers recommend that all wiring repairs be soldered. Solder is an alloy of tin and lead used to make a good electrical contact between two wires or connections in an electrical circuit. However, a flux must be used to help clean the area and to help make the solder flow. Therefore, solder is made with a resin (rosin) contained in the centre, called rosin-core solder.

Solder is available with various percentages of tin and lead in the alloy. Ratios are used to identify these various types of solder, with the first number denoting the percentage of tin in the alloy and the second number giving the percentage of lead. The most commonly used solder is 50/50, which means that 50% of the solder is tin and the other 50% is lead. The percentages of each alloy primarily determine the melting point of the solder.Because of the lower melting point, 60/40 solder is the most highly recommended solder to use, followed by 50/50.

60/40 solder (60% tin/40% lead) melts at 361°F (183°C).

50/50 solder (50% tin/50% lead) melts at 421°F (216°C).

40/60 solder (40% tin/60% lead) melts at 460°F (238°C).

Soldering Procedure:

Soldering a wiring splice includes the following steps.

STEP 1 While touching the soldering gun to the splice, apply solder to the junction of the gun and the wire.

STEP 2 The solder will start to flow. Do not move the soldering gun.

STEP 3 Just keep feeding more solder into the splice as it flows into and around the strands of the wire.

STEP 4 After the solder has flowed throughout the splice, remove the soldering gun and the solder from the splice and allow the solder to cool slowly. The solder should have a shiny appearance. Dull-looking solder may be caused by not reaching a high enough temperature, which results in a cold solder joint. Reheating the splice and allowing it to cool often restores the shiny appearance.

Task: -

Scan below QR code and perform wire joining process or soldering process as mentioned in this video.