Skills in removing and replacing light vehicle electrical units and components

Health and safety

While work is being carried out on the vehicle’s electrical system, it is important that the battery is disconnected or the circuit being worked on is isolated. Failure to do this can result in personal injury or damage to the vehicle’s electronic components.

1 What is the proper way to disconnect the battery?

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2 Find out the appropriate personal protective equipment (APPE) to be used when working on the following components and any specific risks and good practice that should be followed.

<table>
<thead>
<tr>
<th>Components/systems</th>
<th>APPE</th>
<th>Specific risks</th>
<th>Good practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Battery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Wiper motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Components/systems</td>
<td>APPE</td>
<td>Specific risks</td>
<td>Good practice</td>
</tr>
<tr>
<td>--------------------</td>
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<td>---------------</td>
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<tr>
<td>c) Starter motor</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>d) Charging system</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>e) Monitoring and Instrumentation systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Lighting system</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>g) Electric window motor</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Source and use appropriate information

The battery must be disconnected for the removal and replacement of most light vehicle electrical units and components.

3 Working in small groups, complete the table below by researching the batteries, starting and charging systems either for the following vehicles or two vehicles within your workshop or college:

- Mercedes E-class E220 CDi
- Ford Focus 1.8 Zetec

<table>
<thead>
<tr>
<th>Car 1</th>
<th>Car 2</th>
</tr>
</thead>
</table>
| **a)**  
   i) Battery location  
   ii) Number of batteries  
   iii) Battery amps per hour |
<p>| | |
|       |       |
| <strong>b)</strong> Alternator amp rating |
|       |       |
| <strong>c)</strong> Cranking amps |
|       |       |
| <strong>d)</strong> How to reset the radio code |
|       |       |
| <strong>e)</strong> How to reset the window one-touch feature |
|       |       |</p>
<table>
<thead>
<tr>
<th></th>
<th>Car 1</th>
<th>Car 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>f)</td>
<td>Where the fuse box is, and if there is more than one</td>
<td></td>
</tr>
<tr>
<td>g)</td>
<td>Draw a headlamp wiring diagram</td>
<td></td>
</tr>
<tr>
<td>h)</td>
<td>How to reset the seat position memory</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>How to program a remote key fob</td>
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</tr>
<tr>
<td>j)</td>
<td>Can the vehicle be safely jump-started?</td>
<td></td>
</tr>
</tbody>
</table>
Tools and equipment

Selecting the correct tools and knowing how to use them properly is important when carrying electrical tasks safely.

4 A soldering iron is often used to remove and replace component wiring. Use textbooks and the internet to research the following areas. Discuss your findings in small groups and see who sourced the most information.
   a) What are the safety guidelines when using soldering irons?

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   ...................................................................................................................................

   b) What are the risks of working with fumes? Are they toxic?

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   c) What are the risks of working with lead solder?

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   ...................................................................................................................................
   ...................................................................................................................................

   d) What are the guidelines for fire prevention when using soldering irons?

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   ...................................................................................................................................
   ...................................................................................................................................

   e) How should soldering waste be disposed of?

   .....................................................................................................................................
Identify the tools and equipment pictured below. Research how they should be used and stored in order to answer the questions below.

<table>
<thead>
<tr>
<th>Tool/equipment</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>a) What is this equipment used for?</td>
</tr>
<tr>
<td></td>
<td>b) How should it be stored?</td>
</tr>
<tr>
<td>6</td>
<td>a) What is the correct name for the tool in the picture?</td>
</tr>
<tr>
<td></td>
<td>b) How should it be stored?</td>
</tr>
<tr>
<td>7</td>
<td>a) What is this tool used for?</td>
</tr>
<tr>
<td></td>
<td>b) How should it be stored?</td>
</tr>
<tr>
<td>8</td>
<td>a) Why is it important to use this tool?</td>
</tr>
<tr>
<td></td>
<td>b) How should it be stored?</td>
</tr>
</tbody>
</table>
Removal and replacement of components

Removal and replacement of electrical components should always follow a sequence to prevent injury and component damage.

11 Working in small groups, select a vehicle and obtain the relevant headlamp wiring diagram. Carry out the following tasks on the vehicle with the use of the wiring diagram.

**Note:** Be careful – if the vehicle has a high-intensity discharge light system you must disconnect the battery!

a) Disconnect the battery  
b) Locate the headlamp circuit fuse and remove  
c) Check the wiring connection numbers and familiarise yourself with the colour coding  
d) Remove the headlamp unit and inspect for any visible damage  
e) Investigate how the headlamp aim can be adjusted  
f) Refit the headlamp unit  
g) Replace the fuse and reconnect the battery  
h) Reprogram any volatile memories  
i) Check the system operation  
j) Check the headlight alignment
12 Do you need to carry out the steps in question 11 in the suggested sequence or can you do them in a different order? Could you miss out any of the stages?

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**Record information and make recommendations**

With vehicle electrical units and components it is important to check the components before and after replacement to test their performance. Most good-quality diagnostic equipment has a ‘save’ or ‘print’ function, which is a professional and accurate way of recording information which can be attached to the job card or customer bill.

13 In the workshop, find the diagnostic equipment and carry out these basic checks. Record or print out the results.
   a) Battery condition
   b) Charge rate
   c) Bulb resistance
   d) Vehicle fault codes
   e) Towing socket operation (where fitted)

14 Did you use any specialist equipment? If so, what?
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15 Were you able to print out the results?
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**Quick quiz**

Answer the following multiple-choice questions. **Note:** Some questions may have more than one correct answer.

16 What is electrolyte?
   a) A liquid that conducts electricity, such as water
   b) A liquid that conducts electricity, such as battery acid
   c) Battery cells

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Name ............................................................................................................ Date ..............................

17 What is the proper way to disconnect a battery?
  a) Disconnect the positive lead first and reconnect it last
  b) Disconnect the negative lead first and reconnect it first
  c) Disconnect the negative lead first and reconnect it last

18 Which of the following is a risk when using a soldering iron?
  a) Wearing no eye protection
  b) Touching the element tip
  c) Breathing in the fumes

19 What APPE is required when lifting a battery?
  a) Apron and neoprene gloves
  b) Apron and latex gloves
  c) Neoprene gloves and a hard hat

20 Why is a multimeter calibrated?
  a) To give it a warranty
  b) To check its operation
  c) To maintain its accuracy

21 Why do you disconnect the battery when working on the vehicle’s electrics?
  a) To stop it from going flat
  b) To lessen the chance of injury
  c) To stop damage to sensitive electronic components

22 What is voltage a measurement of?
  a) Potential difference
  b) Current
  c) Resistance
Are you ready for assessment?

If you can answer yes to the following questions, discuss with your tutor whether you might be ready to be assessed.

- Can you select the APPE for all removal and replacement of electrical units?
- Do you know the dangers of working with battery acid?
- Can you find and use technical data and information?
- Are you confident that you could remove an electrical unit or component?
- Can you record technical data?
- Can you operate diagnostic equipment?