JUMP STARTING PLANT AND VEHICLES

Introduction

Every year in the UK, at least 25 people are seriously injured when using lead/acid batteries (referred to as batteries) at work. This toolbox talk has been developed to give a basic introduction to working safely with batteries and minimising the risks involved.

Batteries are used to store electrical energy. Many of the things we use every day rely on the instant power provided by batteries. However, the larger batteries found in workplaces can be dangerous and may explode if used incorrectly.

Injuries from batteries include serious chemical burns to the face, eyes and hands, and wounds from flying pieces of metal and plastic. Burns from metal objects that have become very hot or have exploded after short-circuiting the battery's terminals occur frequently. Serious electric shocks and burns are common in accidents involving high-voltage battery packs.

Hazards

Chemical

Batteries are usually filled with solutions (electrolytes) containing either sulphuric acid or potassium hydroxide. These very corrosive chemicals can permanently damage the eyes and produce serious chemical burns to the skin. Sulphuric acid and potassium hydroxide are also poisonous if swallowed.

The lead, nickel, lithium or cadmium compounds often found in batteries are harmful to humans and animals. These chemicals can also seriously damage the environment.

Explosion

Hydrogen and oxygen are usually produced inside a battery when it is being charged. A source of ignition – for example, a flame, a spark, a cigarette or any hot object, electrical equipment, a mobile phone – will often cause mixtures of these gases to ignite and explode. The explosion is often so violent that it shatters the battery and produces a highly dangerous shower of fragments and corrosive chemicals.

Hydrogen and oxygen are produced more quickly as the battery gets close to being fully charged. If you continue charging after the battery is fully charged, a lot of gas will be produced, greatly increasing the risk from explosion.

During charging, gas bubbles often become trapped inside the battery. The mixture of two parts hydrogen to one part oxygen produced is perfect for an explosion.

When a vented battery is moved, the trapped gases are released into the air around the battery. A tiny spark is all that is needed to ignite the gases. If this happens in a confined space (eg inside the battery, or in an enclosure or a poorly ventilated battery room), a violent explosion is likely.

The gases that come out of a vented lead/acid battery during charging often contain a fine mist of sulphuric acid. Take care to avoid breathing these fumes, and wear suitable eye protection.

Valve-regulated ('maintenance-free') batteries are much less likely to release hydrogen than vented batteries. However, it is still important to take care when charging them. Gas pressure may build up inside the battery if it is charged too quickly or for too long. If this happens, the pressure relief valves in the battery may open and let the gases escape. An explosion is likely if this happens close to an ignition source.

Work Safely!

Remember
When working with or near batteries, and also when moving or handling them:

The Dos
- Wear gloves and suitable eye protection, preferably goggles or a visor.
- Wear a plastic apron and suitable boots when handling battery chemicals such as sulphuric acid or potassium hydroxide.
- Empty your pockets of any metal objects that could fall onto the battery or bridge across its terminals.
- Keep sources of ignition – such as flames, sparks, electrical equipment, hot objects and mobile phones – well away from batteries that are being charged, have recently been charged, or are being moved.
- Use suitable single-ended tools with insulated handles.
- Fit temporary plastic covers over the battery terminals.
- Charge batteries in a dedicated, well-ventilated area.
- Share the load with a workmate when lifting batteries – they can be very heavy.
- Use insulated lifting equipment and check there are no tools, cables or other clutter you could trip on.
- Wash your hands thoroughly after working with batteries, especially before eating, smoking or going to the toilet.

The Don'ts
- Work with batteries unless you have been properly trained.
- Smoke.
- Wear a watch, ring, chain, bracelet or any other metal item.
- Overcharge the battery – stop charging as soon as it is fully charged.

Making and Breaking Connections

Many explosions happen when batteries are being connected or disconnected. The sparks produced when this is done incorrectly may cause the battery to explode, especially if it has just been charged. The correct way of making and breaking connections to batteries is as follows.

- Isolate the battery by turning off all the switches in the circuit. If the battery is in a vehicle, turn off the ignition switch as well.
- If the battery consists of a number of smaller connected batteries (cells), shroud the other terminals to prevent short circuits or flashovers when disconnecting the cells.
- **Disconnect the earthed terminal of the battery first.** On most vehicles, this is the terminal attached to the chassis, usually by a short, thick wire. In modern vehicles, the negative terminal (-) of the battery is earthed, but always check to make sure.
- Ensure that the connectors and terminals are clean and secure. Reconnect the earthed terminal last.
- **Remember.** Do not rest metal tools on or near the battery. If they fall across the battery terminals, they will cause a short circuit.

Jump-Starting Process

Jump-starting uses the charged (good) battery of one vehicle to start the engine of a second vehicle with a discharged (flat) battery. Whenever possible, follow the manufacturer's instructions for jump-starting a vehicle. If these are not available, use the procedure described in this section.

First of all, find out whether the negative or positive terminal of each vehicle's battery is connected to the chassis. This is known as the vehicle's earth polarity.

Usually the negative terminal of the battery is connected to the chassis. In this case, the vehicle is said to have negative earth.

If the two vehicles have different earth polarities, the chances of error are much greater. Only competent , authorized people, with suitable experience, are allowed to carry out jump-starting.

Preparation

- Check that the vehicles use the same voltage, eg 12 or 24 volts. If you are not sure that the vehicles have the same voltage, do not proceed.
- Ensure that the two vehicles are not touching.
- Ensure that each handbrake is securely applied and that the two vehicles are in neutral (or in park if fitted with automatic transmission).
- Turn off each ignition switch.
- Use appropriate, colour-coded (red for positive, black for negative) jump leads.
- These should be suitable for the expected electrical current and have insulated handles.
- If using a recently charged spare battery for jump-starting, always allow a minimum of 20 minutes for the gases to vent before connecting the jump-leads.

Connection (for vehicles with the same earth polarity)

- Use the red jump lead to connect the non-earthed terminal of the good battery to the non-earthed terminal of the flat battery. (The non-earthed terminal is the terminal that is not connected to the vehicle's chassis.)
- Use the black jump lead to connect the earthed terminal (the terminal connected to the vehicle chassis) of the good battery to a suitable unpainted metal part of the chassis or engine of the dead vehicle. The point of attachment should be at least 15 cm from the battery and away from fuel and brake lines.

Connection (for vehicles with different earth polarities)

Do not attempt this unless you are competent to do so and have suitable experience.
Follow the steps below.

- Use the **black jump lead** to connect the earthed terminal of the good battery to the non-earthed terminal of the flat battery.
- Use the **red jump lead** to connect the non-earthed terminal of the good battery to a suitable unpainted metal part of the chassis or engine of the dead vehicle. The point of attachment should be at least 15 cm from the battery and away from fuel and brake lines.

Starting the vehicle

- Check that each handbrake is firmly applied and that each vehicle is in neutral or park.
- Make sure that all the leads are clear of anything that might start to move or rotate.
- Start the engine of the good vehicle and increase the engine revs a little to a fast idle (about 1500 rpm) for about one minute.
- Start the engine of the dead vehicle.

Disconnection

- Stop the engine of the good vehicle and turn off the ignition. Leave the engine of the other vehicle running – the battery is still flat, so you will need to drive several miles before it has enough energy to restart the engine.
- Disconnect the leads in the reverse order to the one used to connect them.
- Do not allow the exposed metal parts of the leads to touch each other or other metal parts of the vehicles until both leads have been disconnected.

Remember: If the metal parts of the leads are hot, do not handle them until they have cooled down.

QUESTIONS – (there may be more than one correct answer)

		A	B	C
1	**Injuries from batteries include serious chemical burns to the face, eyes and hands but can be prevented:**	By wearing the appropriate eye protection	By following the manufacturer's instructions, a safe working practice and wearing the appropriate PPE	By applying hand and face cream
2	**According to the HSE what is the least number of persons that are seriously injured each year when using batteries at work?**	5	14	25
3	**Jump leads should have insulated handles and be inspected:**	By the supervisor weekly	Only if they have not been used for a long time	By the user before use
4	**When planning to use jump leads always ensure:**	The vehicles do not touch	That the voltage is the same eg 12 or 24 volts	You have a water fire extinguisher available
5	**Don't work with batteries or jump leads unless:**	The job is stood and the fitter is not on site	You have been authorised	You have been properly trained

Names of those who attended this Toolbox Talk	
Name (Print)	**Signature**
Carried out by Name (Print):	Carried out by (Signature):
Unit:	Date: