Toolbox Talks

Working Safely with Batteries Part 1

Battery Awareness

Batteries provide a portable – & usually safe – source of electrical power for countless applications. From tiny cells used in wristwatches to industrial-size utility backups, batteries keep things working for us.

There are some hazards associated with batteries, however. The chemical reactions required to generate electricity involve toxic & explosive substances, harmful to humans & the environment. Large batteries can deliver fatal electrical shock.

Consider the many uses for batteries in your workplace, such as personal lights, UPS (Uninterruptible Power Supply) units for electronic equipment, power for handcarts & forklifts, alarm & testing equipment, clocks, communications, & bar code readers.

Batteries produce hydrogen gas, also known as H2. This gas is explosive. When an accumulation of hydrogen gas mixes with oxygen in the air & meets an ignition source such as a spark, an explosion occurs. The result is often an eye injury from fragments of a battery or tool. The explosion also propels the hazardous content of the battery, such as sulfuric acid or lead. While it does not happen often, even an ordinary flashlight can explode.

Excess hydrogen gas is likely to be produced when batteries are being charged, & when batteries are mismatched, connected incorrectly, damaged, overcharged, or otherwise misused.

These general safety tips apply to batteries of all sizes:

- Read & follow the manufacturer's instructions.
- Do not mix batteries of different brands.
- Do not mix old & new batteries.
- Do not mix batteries of different types, such as alkaline & non-alkaline, or rechargeable & non-rechargeable.
- Do not use damaged or leaking batteries.
- Observe the correct polarity when installing batteries.

A battery explosion is a serious matter in any work environment, but especially when the atmosphere of the work area is flammable. For use in hazardous atmospheres, observe all safety precautions to prevent fire & explosion. As directed, use lights & batteries designed to minimize the hazards of sparks. Make sure the batteries are in good condition & installed correctly. Open the battery compartment to allow any accumulated hydrogen gas to escape. Of course, you must not inspect your light in a hazardous area or near an open flame.

Many workplaces have battery rooms where large batteries that power mobile equipment are charged & changed. Handling these batteries requires special training to prevent explosions and other kinds of exposure. The rooms have to be well ventilated. Workers need to use the correct battery lifting devices to avoid injury. Heavy batteries being moved from delivery vehicles to storage can also fall & crush toes.

Large stationary batteries are also present in utility settings where they provide temporary power in an outage until the fuel-powered generator kicks in. These high voltage batteries are stored in secure, well-ventilated power rooms. Only trained, authorized personnel who know how to avoid shock, electrical arcing, blast, & chemical hazards should handle them. Even an apparently discharged battery of this size can retain enough electrical power to kill. Combustible materials, sources of ignition – & unauthorized personnel – must be kept away from these areas.

Work Safely: Minimize Risk!

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

Do…

- Wear gloves & suitable eye protection, preferably goggles or a visor.
- Wear a plastic apron & 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, & 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.

& Don't…

- 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.

HAZARDS

Eyes: First, always wear safety goggles or a face shield when working around a battery. Batteries contain corrosive acids that are capable of eating away metals. It takes just one droplet to cause serious eye damage. Just popping open the vent cap may throw out a droplet. A short or faulty regulator can cause the electrolyte to boil, releasing acid vapors. A fault within the battery could cause it to explode, throwing fragments of the case & acid.

Back: Batteries are heavy. If you must move one, use a battery strap as a handle, keep your back straight - don't bend at the waist - & tighten your stomach muscles as you lift. Don't twist your spine as you lift or move it.

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.
- If you own a battery, it is your job to dispose of it properly and without causing unnecessary pollution when it is no longer useful. Many battery-suppliers and scrap metal dealers will do this for you. Transporting scrap batteries by road is subject to certain rules. At the time of publication, these apply when more than six scrap batteries are being moved to a disposal site. You can get up-to-date advice on the proper way to dispose of batteries from your local council or from the Environment Agency.

Toolbox Talks

Working Safely with Batteries Part 2

Jump Starting: Dead batteries in cars & trucks are not uncommon - particularly in winter. The first thought is to get a jump start. When jumping a battery, remember the following safeguards:

- Be sure all electrical equipment is off. If you connect the jumper battery while a load is being drawn, a spark could occur.
- Check the battery fluid level. If the plates are exposed, add water until they are covered. Never add acid.
- Make sure both batteries are of the same voltage.
- Make sure vent caps are in place to prevent electrolyte splash.
- Use good quality jumper cables - at least 10-gauge wire.
- Always be sure of your polarity when arranging the jumper cables:
  - Connect the first cable to the positive (+) terminal of the good battery; then attach the other end of that cable to the positive (+) terminal of the dead battery.
  - Next, attach the second cable to the negative (-) terminal of the good battery, & make the fourth & last connection to a clean metal part, such as the engine block of the car being energized, rather than to its negative battery terminal. This completes the electrical circuit, as if it were connected to the dead battery, but if sparks are produced, it serves to keep them away from any explosive battery gases.
  - Never lay your tools on top of the battery. They could come in contact with both posts, or the positive post & a ground, creating a short.

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 (e.g. 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.

Electrical:

- Batteries contain a lot of stored energy. Under certain circumstances this energy may be released very quickly and unexpectedly. This can happen when the terminals are short-circuited, for example with an un-insulated metal spanner or screwdriver.
- When this happens, a large amount of electricity flows through the metal object, making it very hot very quickly. If it explodes, the resulting shower of molten metal can cause serious burns & ignite any explosive gases present around the battery. The sparks can give out enough ultra-violet (UV) light to damage the eyes.
- Most batteries produce quite low voltages, & so there is little risk of electric shock. However, some large batteries produce more than 120 volts DC. To protect people from the real danger of electric shock, you should:
  - Ensure that live conductors are effectively insulated or protected.
  - Display suitable notices/labels warning of the danger.
  - Control access to areas where dangerous voltages are present.

Shocking Effects

Current (contact 1 second)	Physiological Effect
Less than 1mA	No sensation
1mA	Threshold of feeling. Tingling sensation
5mA	Maximum harmless current
8 -15 mA	Mild shock Start of muscular contraction. No loss of muscular control
15 -20 mA	Painful shock Sustained muscular contraction. Can't let go of conductor
20-50 mA	Can't breathe. Paralysis of the chest muscles Possibly Fatal
50 - 100 mA	Intense pain Impaired breathing Ventricular fibrillation Possibly fatal - Fatal if continued
100-200 mA	Ventricular fibrillation Probably fatal - Fatal if continued Respiratory function continues
Over 200 mA	Sustained ventricular contractions followed by normal heart rhythm (defibrillation) Chest muscles clamp the heart and stop it for the duration of the shock. This also prevents ventricular fibrillation improving the chances of survival, but other factors come into play. Burns Temporary respiratory paralysis. Possibly fatal - Fatal if continued
Over 1 Amp	Severe burns. Internal organs burned. Death Survivable if vital organs not in current path - e.g. across a finger or hand

Chart found at

All information found at safetytoolboxtalks.com, toolboxtopics.com, & hse.gov.uk