

# Forklift Trucks

## Forklift Trucks - Batteries

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## Why is it important to follow safety procedures when charging batteries?

The use, handling and charging of batteries in the workplace can be hazardous. It is important to identify and assess the hazards and risks, and to have the appropriate control measures in place to protect workers. The hazards and risks associated with a battery will depend on the type of battery, how it is used, how it needs to be charged and maintained, and the area where it is being charged and used, among other factors.

Workplaces should always make sure that procedures and practices are developed based on the battery's manufacturer's instructions and recommendations. Requirements from occupational health and safety legislation, building codes, electrical codes, and fire codes must also be followed.

Always make sure the charging stations and devices have a Canadian certification mark (such as from the Canadian Standards Association (CSA) or Intertek (cETL)), indicating they meet Canadian electrical safety standards (jurisdictions may specify which certification marks are acceptable).

In all cases, workers should be trained on safe work procedures, spill response, first-aid, and other related duties. Refer to the manufacturer's instructions and safety data sheets (SDS).

NOTE: This OSH Answers document provides general guidance for industrial lead-acid batteries used to operate forklifts and is not meant to replace the requirements from the manufacturer or legislation.

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## Why should you follow safety precautions when charging batteries?

Lead-acid batteries contain sulfuric acid. Only trained and authorized personnel should handle them. When talking about lead-acid batteries, people usually call sulfuric acid "battery acid" or the "electrolyte". An electrolyte is a general term used to describe a non-metallic substance like sulfuric acid or salts that can conduct electricity when dissolved in water.

Lead-acid batteries can produce explosive mixtures of hydrogen and oxygen gases when they are being charged. Note that in some cases, hydrogen gas has been found to interfere with carbon monoxide detectors. Check with your detector manufacturer(s) for more information.

- Charge batteries only in approved, well-ventilated battery-charging areas.
  - Install a safety shower and an eyewash station in a battery-charging area.
  - Always follow the manufacturer's instructions for safely charging the battery.
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## What are some precautions to use when watering a battery?

During the normal operation of a forklift with a flooded lead acid battery, the water in the electrolyte evaporates and needs to be refilled (watered) to keep the battery operating effectively and safely.

- Develop procedures based on the manufacturer's instructions on how and when to water the battery.
  - In general, a battery should be watered after it has been fully charged and cooled down.
  - Do not water a battery before or during charging, as the water may boil over and cause acid to leak.
  - Use distilled water (not tap water) to refill the electrolyte.
  - Never add sulfuric acid to the electrolyte.
  - Wear appropriate personal protective equipment (PPE) such as eye and face protection (e.g., chemical-resistant splash-proof goggles and face shield), and chemical-resistant gloves. Other personal protective equipment, such as a chemical-resistant apron and footwear, may also be necessary to protect against incidental exposure to the electrolyte. Do not store batteries in hot locations or in direct sunlight. Keep away from combustible and flammable items.
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- Use extreme care to avoid spilling or splashing the electrolyte. It can destroy clothing and burn the eyes and skin.
- Make sure spill response equipment and personal protective equipment are readily available, and that spill response procedures have been developed.
- Neutralize spilled or splashed sulfuric acid (electrolyte) with an appropriate neutralizing solution (e.g., baking soda solution), clean the spill area using spill response supplies (e.g., cleaning pads, disposable bags), and rinse the area with clean water. Make sure appropriate personal protective equipment is worn.
- Dispose of contaminated items safely.

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## What do I do if someone gets sulfuric acid (electrolyte) on their skin?

Emergency response and first-aid procedures should be developed in the case of worker exposure.

An example of a first-aid procedure is:

- As quickly as possible, flush the contaminated area with lukewarm, gently flowing water for at least 30 minutes using an emergency eye wash station or shower.
- If irritation persists, repeat flushing.
- **DO NOT INTERRUPT FLUSHING.** If necessary, keep the emergency vehicle waiting if advised by medical professionals.
- Do not rinse contaminated water into the unaffected eye, or onto other areas such as the face or skin.
- Under running water, remove contaminated clothing, shoes, and other leather goods (e.g., watchbands, belts). Discard contaminated clothing, shoes, and leather goods.
- First aiders should avoid direct contact. Wear chemical protective gloves, eye and face protection and other PPE, if necessary.
- Quickly transport the person to an emergency care facility or call 911. If it is safe to do so, continue flushing during transport.
- Safely dispose of contaminated clothing, equipment, and materials.

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## What do I do if someone gets sulfuric acid (electrolyte) in their eyes?

- Avoid direct contact. Wear chemical-resistant gloves, if necessary.

- Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes, while holding the eyelid(s) open. Neutral rinsing solution may be used as soon as it is available.
  - DO NOT INTERRUPT FLUSHING. If necessary, keep the emergency vehicle waiting if advised by medical professionals.
  - Do not rinse contaminated water into the unaffected eye or onto the face.
  - Call 911 and quickly transport the victim to an emergency care facility.
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## Why is there a danger of batteries exploding?

The charging of lead-acid batteries can be hazardous. When batteries are being recharged, they generate hydrogen gas that is explosive in certain concentrations in air (the flammability or explosive limits are 4.1% to 72% hydrogen in air). The spark-retarding vents help slow the rate of release of hydrogen, but the escaping hydrogen may form an explosive atmosphere around the battery if ventilation is poor. The ventilation system should be designed to provide an adequate amount of air exchange for the number of batteries being charged. This level of ventilation is essential to prevent an explosion.

- Always keep sparks, flames, burning cigarettes, and other ignition sources away from the battery recharging area.
  - Wear protective eyewear when working near batteries.
  - Do not break "live" circuits at the terminals of batteries.
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## What should I do when charging batteries?

- Check the electrolyte level before recharging. If the battery has been outside in cold weather, make sure that the battery is not frozen before recharging it.
- Check the fluid level after the battery has been recharged. If the electrolyte covers the top of the plates, do not add more water. If water is added, use distilled water, not tap water.
- Check that the battery ventilation holes or plugs are clear to allow hydrogen gas to escape.
- When vent plugs need adjustment, follow the manufacturers' instructions carefully.
- If the battery has sealed vents, do not recharge the battery with a current greater than 25 amps.

- To reduce the possibility of explosions, follow the recommendations of the recharger manufacturer for attaching and removing cables and for operating the equipment properly. Generally, these recommendations include unplugging or turning off the charger before connecting or disconnecting the clamp connections. Carefully attach the clamps to the battery with the proper polarity (positive [+] clamp, usually red, to the positive terminal and negative (-) clamp, usually black, to the negative terminal).
- Do not exceed the recommended charging time or overcharge a battery.
- Only use charging devices that are manufacturer-approved and appropriate for the voltage and amp-hours (ah) of the battery.
- Ensure that the area is ventilated when the batteries are being charged. Check the health and safety legislation, fire codes, and building codes that apply to your workplace. Guidelines for ventilation in battery charging areas, based on the National Fire Protection Agency Standards (NFPA 855), are provided below:

**Natural exhaust ventilation:** designed to limit the concentration of flammable gas to 25% of the lower explosive limit (LEL) during the worst-case scenario of charging all batteries at the same time.

**Mechanical Ventilation:** an exhaust ventilation rate that is effective at limiting the maximum concentration of hydrogen to 1% of the total volume of the room or area during a worst-case scenario when all batteries are being charged at the same time. Alternatively, having a ventilation rate based on the area of not less than 1ft<sup>3</sup> / min / ft<sup>2</sup> of the floor area of the room.

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## What should I do when servicing batteries?

- Only workers who are trained and qualified should service a battery
- Keep metal tools and jewelry away from the battery.
- Use non-metallic containers and funnels.
- Wear appropriate personal protective equipment (PPE) including splash-proof goggles, and chemical-resistant apron and gloves. A face shield may also be necessary.
- Inspect for defective cables, loose connections, corroded cable connectors or battery terminals, cracked cases or covers, loose hold-down clamps and deformed or loose terminal posts.
- Replace worn or unserviceable parts.

- Check the state of charge of non-sealed and sealed batteries with an accurate digital voltmeter while the engine is not running and lights and other electrically-powered equipment are turned off. Also, check the electrolyte levels and specific gravity in each cell of non-sealed batteries. Follow the battery manufacturer's recommendations about when to recharge or replace batteries.
- Tighten cable clamp nuts with the proper size wrench. Avoid subjecting battery terminals to excessive twisting forces.
- Use a cable puller to remove a cable clamp from the battery terminal.
- Remove corrosion on the terminal posts, hold-down tray and hold-down parts.
- Use a tapered brush to clean battery terminals and the cable clamps.
- Wash and clean the battery, battery terminals, and case or tray as recommended by the manufacturer.
- To prevent electric shocks, never touch or come in contact with both terminals at the same time.
- When battery cables are removed, ensure that they are clearly marked "positive" and "negative" so that they are reconnected with the correct polarity.
- Use a battery carrier to lift a battery, or place hands at opposite corners. Remember, batteries can weigh 30 to 60 lb (about 14 to 27 kg). Practice safe lifting and carrying procedures to [prevent back injuries](#).
- Use a self-levelling filler that automatically fills the battery to a predetermined level. Never fill battery cells above the level indicator.
- Do not squeeze the syringe so hard that the water splashes acid from the cell opening.

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