SECTION 7
BATTERY CHARGING AND CHANGING

Section 7 Objectives

At the end of this section, you will be able to:

1. Explain the safe way to handle industrial batteries.
2. Define the hazards of working with batteries.
3. Describe the proper methods of charging and changing industrial batteries.

Importance Statement

It is important that you:

1. Reduce the risk of personal injury to you.
2. Reduce the risk of property damage caused by improperly handling and maintaining industrial batteries.

Voltage Configuration

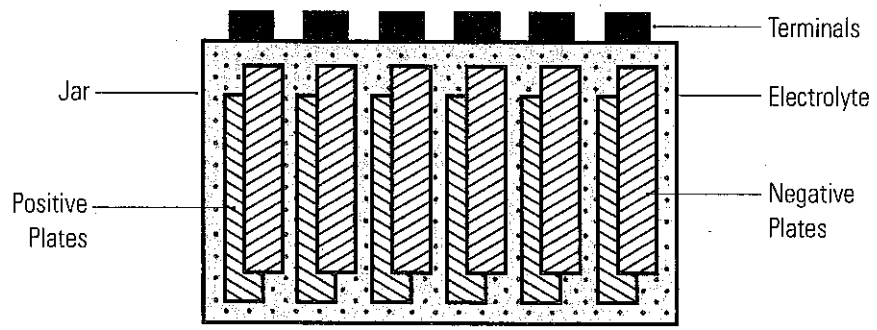
Electric powered lift trucks typically come in primary voltage configurations. In North America, the primary configurations are 24, 36 and 48 volts.

Battery Size Affects The Following:

- Vehicle lifting capacity
- Vehicle stability
- Charge life
- Work cycle duration.

Make sure the battery weight is within the minimum and maximum range that is indicated on the truck's capacity plate.

What Is An Industrial Battery?



- Six or more cells are connected in series.
- Each cell consists of group of positive and negative plates.
- Cells are submerged in electrolyte.
- Each fully charged cell equals 2.2 volts.
  - Number of cells x 2 = battery voltage.

Battery Hazards

- Weight of the battery

  Industrial batteries weigh 2,000 pounds or more. You should always use the proper lifting equipment when changing batteries.

- Acid

  Batteries contain sulfuric acid that is highly corrosive. When charging or changing batteries, always wear the required personal protective equipment. This includes a rubber apron and rubber gloves, face shield, and goggles.

  If any body part is exposed to the acid, immediately go to the nearest eyewash station and flush the affected body part for at least 15 minutes. Then seek medical attention.

- Explosive fumes

  Toward the end of the battery charging process, batteries give off highly explosive hydrogen fumes. The battery charging area must be properly ventilated to dissipate these fumes as only a small amount of hydrogen gas can be highly explosive. Never smoke or expose batteries to sparks or flames.

- Electrical

  When working with batteries, remove all conductive jewelry. Also, keep metal tools and chains away from the batteries. Contact with battery cells can cause an electrical short circuit. Shorts will cause severe burns on unprotected skin.

News Flash!

An employee was severely burned when changing a battery on his lift truck. He was checking water levels with a match and ignited gas fumes. The acid-based fluid sprayed over his body, causing burns to his face, arms, and neck.

What happened?

Battery Safety

- Follow company procedures
- Observe safety rules
- Wear personal protective equipment:
  - Rubber apron
  - Rubber gloves
  - Safety goggles
  - Face shield
- Be trained and authorized
- Remove all conductive jewelry

Changing Industrial Batteries

- Designated areas only
- Insulated battery beam
- Plywood if terminals are exposed
- Hoist with enough capacity
- Clear removal route
- Install fully charged battery
- Make sure battery restraint is in place
- Make sure battery is properly restrained – battery should not move more than one-half inch

Charging An Industrial Battery In A Truck

- Be in a designated area only. Designated charge area must be well ventilated.
  - Hydrogen gas is released during charge. Hydrogen is lighter than air.
- Park truck and set brake. Neutralize controls. Lower forks to ground.
- Open battery compartment fully.
- Unplug battery from truck and connect to compatible charger.
  - Do not plug charger into truck connection.
- Check cables and connectors for damage, exposed wire.
- Charge per battery manufacturer's instructions.
- After charging, turn off charger first, then disconnect cable.
  - If you disconnect the cable first, you could cause a spark and ignite the hydrogen gas.

Watering Batteries

- Always add water after a charge to prevent boilover.
  - Note: The exception is to add water before a charge only if the separator plates are exposed. Then add only enough water to cover the plates.
- Use distilled water when possible. Use tap water that has been analyzed and approved by the battery manufacturer.
- Never attempt to add acid!

Ensuring Maximum Battery Life

- Discharge battery to manufacturer's recommended level, usually 80 percent.
- Batteries typically have a life of 1,500 to 2,000 cycles. A cycle is one complete discharge and one complete charge.
- Avoid quick or opportunity charges.
  - Does not sufficiently charge battery
  - Shortens battery life by removing a cycle
- Run battery for 8 hours, charge for 8 hours, and let it cool for 8 hours.
- Do not overcharge battery:
  - Creates high temperatures
  - Produces a high amount of oxygen and hydrogen
  - More frequent watering is required
  - Electrolyte boils out
  - Shortens battery life
- Do not undercharge battery:
  - Causes plates to become dry and brittle (sulfation) because of high concentration of electrolyte at bottom of cell
  - Full voltage is not achieved, resulting in poor performance.
  - Battery life is shortened.
- Clean battery periodically, using a neutralizing agent and water.

End of Section 7

The 10 Commandments Of Good Battery Care

1. Add approved water only – never add acid.
2. Keep electrolyte level above separator plates.
3. Keep battery top clean and dry.
4. Keep flame and metal away from battery top.
5. Keep vent caps tightly in place.
6. Do not use battery with specific gravity below 1.120.
7. Cool battery before charging or operating if battery is above 115 degrees Fahrenheit.
8. Charge only at proper voltage and amp hour.
9. Keep truck compartment and battery cover open during charge.
10. When in doubt, contact your battery dealer.

Battery Charging And Changing: Course Review

1. Battery size affects:
   A. Lifting capacity
   B. Lift truck stability
   C. Charge life
   D. All of the above

2. If you are exposed to electrolyte, the first thing you need to do is:
   A. Seek medical attention
   B. Go to the nearest eyewash station and flush the affected body part
   C. Wait until the shift is over
   D. None of the above

3. After charging a battery, always turn the charger off first before disconnecting the battery from the charger.

   True_____ False_____

4. Normally, you should add water to a battery only:
   A. Before charging
   B. It doesn't matter when you add water
   C. After charging
   D. None of the above

5. You should remove all metallic jewelry before servicing or charging batteries, because:
   A. Jewelry is magnetized to the battery
   B. If it touches the battery, you could get burned
   C. You may lose it

6. Giving a wet cell battery a quick or opportunity charge is very beneficial to a battery.

   True_____ False_____

APPENDIX A
DESIGNATIONS FOR POWERED INDUSTRIAL TRUCKS / FEDERAL OSHA STANDARD 29CFR1910.178 (B)

D	Diesel powered units with minimal acceptable safeguards against inherent fire hazards
DS	Additional safeguards to exhaust, fuel, and electrical systems
DY	All safeguards of DS units and, in addition, any electrical equipment is completely enclosed. They are equipped with temperature limitation features.
DX	Electrical equipment and fittings are designed, constructed, and assembled so units can be used in atmospheres containing specifically named flammable vapors, dusts, and, under certain conditions, fibers.
E	Electric powered units with minimal acceptable safeguards against inherent fire hazards
ES	Additional safeguards to electrical system to prevent emission of hazardous sparks and to limit surface temperatures.
EE	Same as E and ES, and, in addition, electric motors and all other electrical equipment is completely enclosed.
EX	Electrical equipment and fittings are designed, constructed, and assembled so units can be used in atmospheres containing specifically named flammable vapors, dusts, and, under certain conditions, fibers.
G	Gasoline powered units with minimal acceptable safeguards against inherent fire hazards
GS	Additional safeguards to exhaust, fuel, and electrical systems
LP	Liquefied petroleum gas units with minimal acceptable safeguards against inherent fire hazards
LPS	Additional safeguards to exhaust, fuel, and electrical systems
CN	Compressed natural gas powered units with minimal acceptable safeguards against inherent fire hazards
CNS	Additional safeguards to exhaust, fuel, and electrical systems
G/CN	Units that operate on either gasoline or compressed natural gas having minimal acceptable safeguards against inherent fire hazards
GS/CNS	Additional safeguards to exhaust, fuel, and electrical systems
G/LP	Units that operate on either gasoline or liquefied petroleum gas having minimal acceptable safeguards against inherent fire hazards
GS/LPS	Additional safeguards to exhaust, fuel, and electrical systems

Class I Locations

Locations in which flammable gases or vapors are, or may be, present in the air in quantities sufficient to produce explosive or ignitable mixtures:

A Acetylene

B Hydrogen

C Ethyl ether

D Gasoline, naphtha, alcohols, acetone, lacquer, solvent, benzene.

Class II Locations

Locations which are hazardous because of the presence of combustible dust:

E Metal dust

F Carbon black, coal dust, coke dust

G Grain dust, flour dust, starch dust, organic dust.

Class III Locations

Locations where easily ignitable fibers or flyings are present but not likely to be in suspension in quantities sufficient to produce ignitable mixtures:

Baled waste, cocoa fiber, cotton excelsior, hemp, istle, jute, kapok, oaku, sisal, Spanish moss, synthetic fibers, tow.

Division 1

Conditions exist continuously.

Division 2

Conditions do not normally exist. For fibers, Division 2 is where fibers are stored and handled but not processed or manufactured.