

## 6. BATTERY MAINTENANCE

Lead acid batteries are used in hospitals to start vehicles and emergency generators or for lighting including mobile theatre lamps. They are also used as part of solar power systems.

It is essential that they are well maintained.

A lead acid battery should be stored in a cool (but not cold), clean, well ventilated place. (In some instances it will be kept where it will be used – for example, if it is a vehicle starter, it will be kept in the vehicle.)

### 1. Care of battery terminals

Battery terminals often become corroded. They should be cleaned as soon as this is noticed. Corrosion forms a white/green powder around the terminal. It will affect the efficiency of the battery. See Figure 7. A smear of vaseline (or similar substance) will minimize corrosion build-up.

#### i. Before working on or near a battery:

- make sure you are well away from flames and lighted cigarettes
- wear eye protection and rubber gloves as sulphuric acid can burn
- remove metal wristwatches, necklaces etc as they may come into contact with battery acid and cause burns
- never smoke during work. The gases are volatile and inflammable
- always have a container of water nearby in case eyes or skin are affected. If this happens, soak in cold water and seek medical help at once.

Battery safety is illustrated in Figure 8.

The battery terminals often become corroded, this can be identified by the formation of a white or green powder around the terminal.

Once noticed it should be cleaned off as soon as possible as it will damage the termination and affect the performance of the battery.

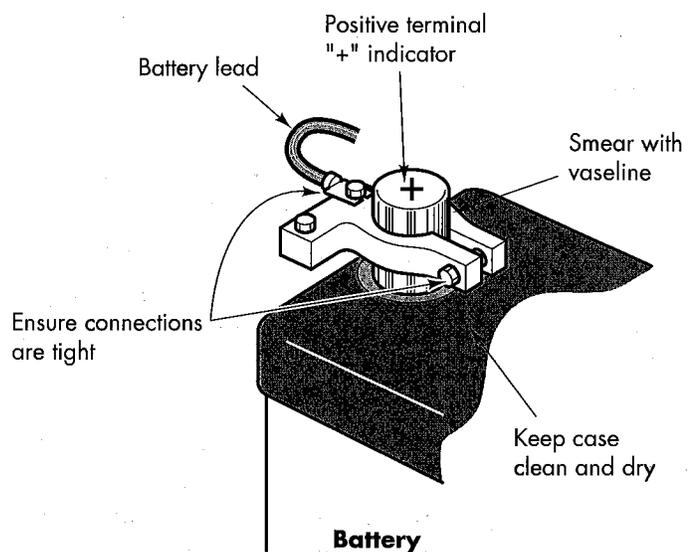


Figure 7: Care of battery terminals

Batteries contain corrosive liquid. **Handle with care.**

**Always** keep battery cells upright.

**Do not** lift battery cells by the terminals.

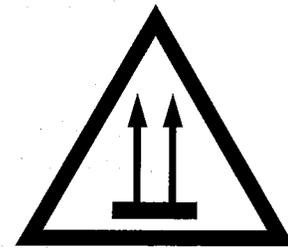
Use the carrying straps provided.

Batteries generate gases that can explode.

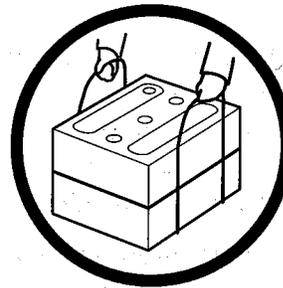
Keep naked flames away from batteries.

Remove all metal from hands, wrists, neck etc. before connecting or disconnecting batteries.

Keep the battery in a well ventilated place.



This way up



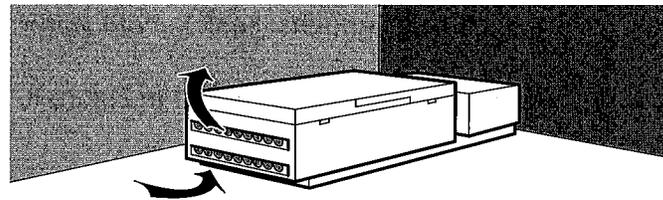
Use the carrying straps



No naked lights



No jewellery



Keep in a ventilated place

**Figure 8:** Battery safety

**ii. To clean a battery:**

- disconnect terminal leads one at a time. **MAKE SURE THEY DO NOT COME INTO CONTACT WITH EACH OTHER UNTIL FREE FROM BATTERY.** Any contact with each other will produce a fierce electric arc which can cause burning
- keep battery upright
- remove battery to a suitable table or bench
- brush terminals gently with a wire brush until all powder has been removed. A little hot water is also very effective.
- brush connections on the battery leads until all powder has been removed
- **TREAT THE POWDER YOU HAVE REMOVED WITH GREAT CARE. DISPOSE OF IT CAREFULLY. CLEAN ALL SURFACES ON WHICH YOU HAVE BEEN WORKING.**
- coat terminals and connections with a light smear of vaseline

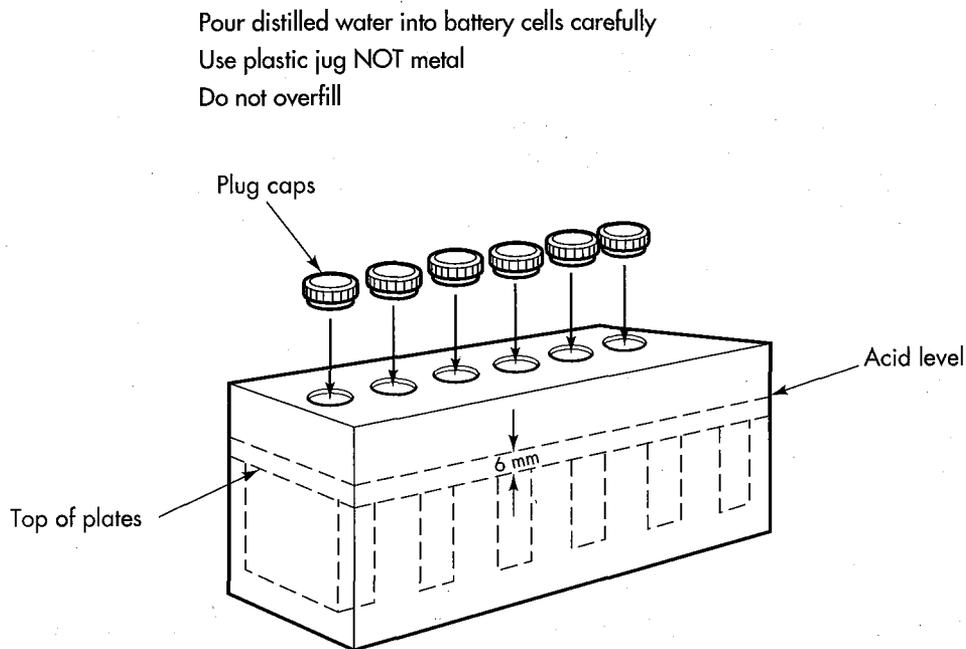
- return battery to its position
- reconnect battery. FIT CONNECTIONS TO TERMINALS ONE AT A TIME. DO NOT ALLOW CONNECTIONS TO TOUCH EACH OTHER. MAKE SURE CONNECTIONS ARE SECURE.
- check that the connections are fitted correctly:  
the positive terminal is marked '+' and the battery lead is RED  
the negative terminal is marked '-' and the battery lead is either BLACK or BLUE
- CHECK AGAIN BEFORE SWITCHING ON THE MACHINE
- wipe the top of the battery case with a dry clean cloth

## 2. Topping up the acid level of batteries

Because water evaporates, the level of acid in a battery drops and should be checked weekly:

- remove vent caps and check that the acid level is approximately 6mm above the battery plates (Figure 9)

DO NOT INSERT ANY METAL OBJECT TO CHECK THE ACID DEPTH



**Figure 9:** Topping up acid (electrolyte)

If plates are not covered:

- top up with distilled water (rain water may be used but distilled water is preferable). Small quantities of distilled water can be produced by using the simple method shown in Figure 10.

DO NOT USE A METAL JUG FOR FILLING THE BATTERY

When the correct level has been reached:

- replace vent caps
- wipe the top of the battery case

If your battery needs water to be added to bring the liquid level to Max. and you do not have a supply of distilled water, we recommend that you follow the instructions below:-

1. Boil a quantity of drinking water in a kettle with a spout.
2. Collect the steam as shown so that it cools and drops as water into a clean container.

Remember that small quantities of certain materials can 'poison' a battery and make it work badly, so it is important not to use untreated water which contains dissolved materials (such as bore-hole water).

Simple materials can be adapted to make distilled water; for example by collecting steam from a boiling kettle and forcing it to condense in a copper pipe coil. This is a simple still, as illustrated.

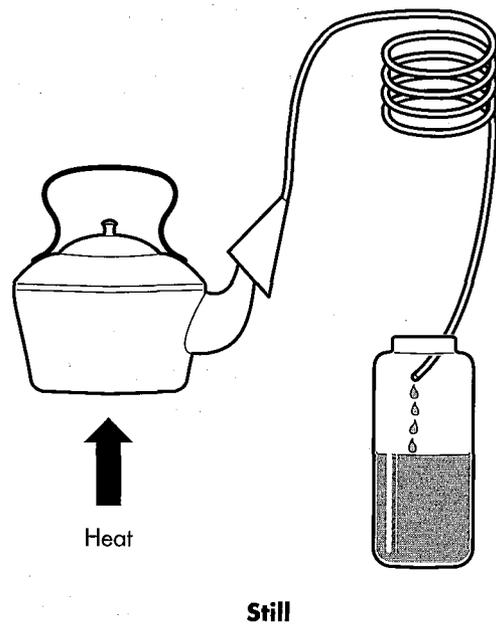


Figure 10: How to prepare distilled water

### 3. Checking specific gravity

The specific gravity of a battery indicates its capacity to provide power. This also should be checked weekly. The procedure and the equipment needed are shown in Figure 11.

#### 4. Safety

Lead acid batteries can be dangerous. **HANDLE AND MAINTAIN CORRECTLY.**

Remember the following **SAFETY** points:

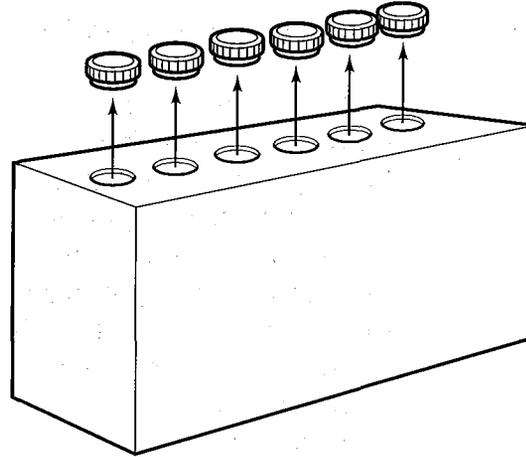
- Do keep battery in a clean, dry, well ventilated place
  - Do remove all watches and jewellery before beginning to work on a battery
  - Do keep flames and lighted cigarettes away from the area
  - Do wear protective gloves and eye shield
  - Do switch off machine before disconnecting battery
  - Do keep the battery upright
  - Do disconnect one battery lead at a time
  - Do make sure leads do not come into contact with each other until both are disconnected
  - Do make sure that correct terminals are used when reconnecting leads
  - Do check again before switching on the equipment
- 
- Do NOT try to test battery strength by short-circuiting battery terminals
  - Do NOT lift battery by its terminals

A list of danger signs for display and for use at training sessions is given in Figure 8.

**Procedure for measuring specific gravity.**

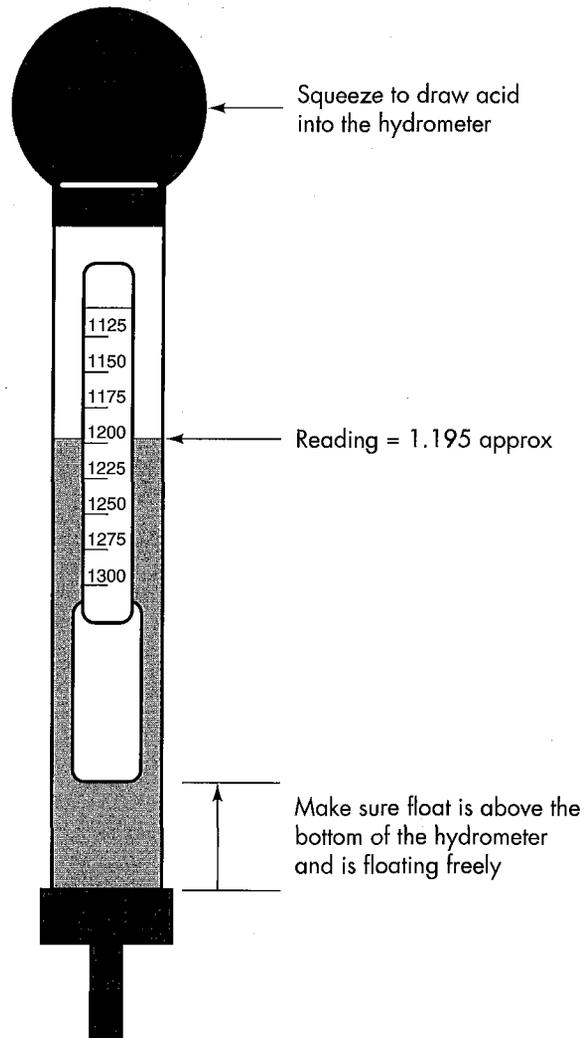
**1. Remove the vent caps**

Put on protective gloves as recommended for any work that may involve contact with battery acid. Remove the battery cell vent caps.



**2. Hydrometer use**

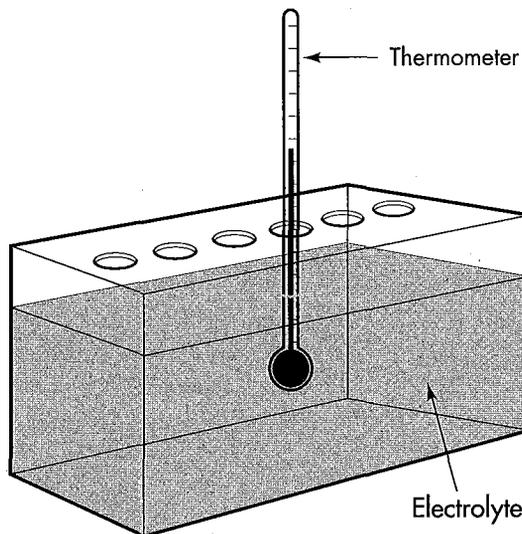
Squeeze the rubber bulb, insert the hydrometer into the electrolyte, then release the bulb to draw enough electrolyte into the hydrometer to make the indicator float freely. Record the reading - for example 1.195. Return the acid to the same cell, being careful not to spill any acid. Repeat the process to obtain a measurement for each cell.



**Figure 11: Checking the battery**

### 3. Thermometer use

Insert the thermometer into the electrolyte. The bulb of the thermometer must be in the electrolyte but not touching the battery plates. Wait until the temperature shown has stabilised. Measure and record the electrolyte temperature. Repeat this procedure for each cell in the battery.



### 4. Temperature correction

Using the table showing the temperature correction to specific gravity, record the correction value.

For 25 degrees celsius the correction is +0.007

Add the value from step 2 to the value from step 4 as follows:

$$\begin{array}{r} 1.195 \\ + 0.007 \\ \hline 1.202 \end{array}$$

- 1.260 – 1.290 Fully charged battery in good condition
- 1.230 – 1.260 Battery becoming discharged but still serviceable
- 1.200 – 1.230 Battery needs charging
- 1.100 – 1.200 Battery discharged. If left in this condition for any length of time, permanent damage will be caused.

**Temperature corrections to specific gravity readings (to 15°C)**

Electrolyte temperature ° C	Correction to specific gravity
55	+0.028
50	+0.024
45	+0.021
40	+0.017
35	+0.014
30	+0.010
25	+0.007
20	+0.003
15	0.000
10	-0.003
5	-0.007
0	-0.010