



**Care and Maintenance  
Instructions for**



**Lead Acid  
Tubular  
Traction Batteries**

**Panacea Alloys Private Ltd.**

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## **Introduction:**

The 'UNION' Tubular Traction Batteries, manufactured by UBPL, India have proved to be an extremely reliable source of power supply in every application.

'UNION' traction batteries are designed and manufactured to give excellent performance coupled with long battery life. However the life of any traction battery is also dependent upon the care and maintenance that it receives. These guidelines are intended to provide the user with the knowledge required to obtain the very best from the battery.

Whilst ordering traction batteries, the capacity of the batteries must be same as the capacity recommended by the vehicle manufacturer.

A smaller capacity battery would be insufficient for complete daily cycle and is likely to get heated during use.

Whilst ordering a charger suitable for recharging the battery, use a sufficiently longer duration for charging, particularly in tropical conditions.

A fast charger meant for temperate climate batteries of 6 to 8 hours would give a warm battery at the end of charge in tropical climate.

Battery life is affected by temperate as corrosion process of positive plate conductor is hastened at high temperatures. Lower the temperature, higher is the life expectancy.

Similarly lower the depth of discharge, higher is the life expectancy.

## **Receipt and Commissioning of Battery:**

**For Battery received filled and charged:** Remove all packing material and carefully examine the Container, etc. to ensure that there is no physical damage. If you do not wish to put charged battery into service immediately, a freshening charge must be given once in a month. This will keep it in a healthy, trouble-free condition.

**For battery received unfilled and dry charged:** A few days before the battery is required for service, commission it as follows:

Remove any seal on the vent plugs and fill each cell with Battery grade diluted sulphuric acid to the upper level indication ridge on the baffle or 15mm above separators/separator guard if no indicator present.

## The Strength of the filling acid should be as follows:

For batteries to be used in temperate climates, the filling acid sp. gr. should be 1.260 corrected to 30°C. For batteries to be used in tropical climates, the filling acid sp. gr. should be 1.230 corrected to 30°C.

Note: Tropical Climate is defined as the condition when the air temperature frequently exceeds 32°C.

Replace the vent plugs (do not fix tight) and allow the battery to stand for a period of 2 hours minimum, 16 hours maximum. It may be found convenient to fill in the afternoon and commence charging the next day.

Restore the level of the electrolyte in the cell with a further addition of acid of the same sp. gr. as before. The battery is now ready for charging.

The initial (first) or commissioning charge can be completed in about twelve to fifteen hours by charging at a current equal to one twelfth of the rated ampere hour capacity at the five hour rate (C5Ah).

This rate of charge in some cases may be provided by the normal vehicle battery charge suitably adjusted or alternatively, the first charge may be carried out at normal equalising current rate provided and the charge be continued for proportionally longer period (so that the Ah input is maintained.)

During commissioning charge the temperature shall not exceed 43°C (50°C under tropical conditions). Should the temperature of the electrolyte in cells exceed, suspend the charge until and sp. gravity.

Fully charged sp. gravity shall be as under:

For temperate climate       $1.280 \pm 0.005 (30^\circ\text{C})$

For tropical climate       $1.250 \pm 0.005 (30^\circ\text{C})$

The Battery is now ready for installation.

## **Handling & Installing the motive power Batteries:**

Motive power batteries are heavy and therefore require adequate mechanical handling systems. During lifting the battery should be in upright position so that no electrolyte is spilt by tilting.

Always use the lifting points locked on the sides of the battery container. For any reason if the battery is being slung by rope or chain, place a piece of timber of sufficient length between the arms of the sling to prevent the crushing strain on the container.

For safety, inspect the lifting points on the steel crate periodically for corrosion or damage. Never lift damaged battery container as there is risk of collapse. Do not allow the lifting equipment to short circuit the cell terminals or connectors.

### **Installation of Battery on the vehicle:**

Wipe over the tops of cells with a damp cloth to remove all dust, water or split acid during commissioning charge.

Check that all connections are tight and cover them with a thin coating of petroleum jelly. Make sure that all the cells are accessible for testing and topping up, this will help to make regular maintenance. Check that battery compartment is well drained and ventilated and that there is no risk of metal objects dropping on to the top of cells causing short circuits. Check that the battery sits quite firmly and securely in its housing and if necessary use packing.

The cables should be flexible and of sufficient length to prevent any strain being imposed either on the cable or the terminals to which the cables are connected.

### **Discharging the Battery on the Vehicle:**

The life obtained from a battery is directly related to the depth of discharge that the battery receives in each discharge cycle. Deeper the discharge, lesser is the life.

Under no circumstances should the depth of discharge exceed 80% of the battery's rated capacity. The battery will still continue to function after 80% limit has been reached and careful control is therefore necessary to ensure that the battery is not over discharged. Battery discharge indicators can provide an indication of the state of charge.

To check the depth of discharge, measure carefully the strength of electrolyte using a hydrometer. The recommended minimum readings are as follows:

DT series 1.180 for temperate: 1.150 for tropical at 30°C

BT series 1.150 for temperate: 1.120 for tropical at 30°C

It is recommended that the battery is discharged evenly and the use of tapping across a part of the battery is avoided. Where a tapping selector switch is provided this should be rotated preferably one step every day. The use of DC - DC converters to allow auxiliary loads to be supplied from the whole battery is recommended.

Battery performance is directly related to temperature. Batteries are rated with 1.280 sp. gr. acid at 30°C in line with B. S. 2550 / IS : 266 and where the battery temperature is lower than this the available performance is reduced. Additional battery capacity is therefore required where they are used in areas of low ambient temperatures.

The temperature correction of capacity to access capacity at higher or lower temp, than 30°C is as follows:

$$C_{30} = \frac{C_t}{1 + 0.008(t - 30)}$$

where

$C_{30}$  = capacity (Ah) at standard temp. 30°C

$C_t$  = capacity at  $t^\circ\text{C}$  (Ah)

$t$  = temperature ( $^\circ\text{C}$ ) at which capacity is to be calculated

### Measurement of Specific Gravity, Voltage & Temperature:

#### Specific Gravity:

The sp. gravity dilute sulphuric acid varies with temperature and it is necessary to apply a correction which relates the value back to the standard temperature of 30°C.

For every 10°C above 30°C, add 0.007 to the Hydrometer reading.

For every 10°C below 30°C, subtract 0.007 to the Hydrometer reading.

#### Voltage:

Lead acid cell has open circuit voltage of approx. 2.1 volts. On discharge the voltage will drop in accordance with current and duration.

On recharge cell voltage would rise through gassing potential of 2.35 volt and reach about 2.6 volts per cell at the end of charge.

The voltmeter used for tests shall be of an accuracy class not inferior to 0.5. The resistance of the voltmeter used shall be at least 1000 ohms per volt.

## Temperature:

High temperature operation can adversely affect life of the battery and the electrolyte temperature should not be allowed to exceed 50°C.

Temperature rise occurs during charge especially during the final gassing period can also occur during discharge when discharged at high rates.

### Recharging the battery following discharge:

The battery should be recharged as soon as possible after the end of discharge.

Recharging must be carried out using an approved motive power battery charger.

The basic function of a charger is to return fully the energy removed from the battery during discharge in a manner that is not detrimental to the battery.

To avoid undue temperature of rise in the final phases of charge, the charges has taper of profile characteristic which ensures that the current is decreased as the charge progresses.

The end point at which to terminate the charging is either achieved automatically or by sensing when the battery enters the gassing phase, and then continuing the charge for a controlled or proportional time interval.

The gassing phase is indicated by the voltage reading 2.35 volt per cell. For manually set controllers the duration of charge after this point is usually 3 hours, but can be slightly longer if the battery is reaching end of life or if the loading of the battery is very uneven.

Excessive charging beyond gassing stage increases water loss from cells, wastes electricity and also reduces battery life.

The largest charger size permissible is the one that is designed to recharge a battery in 7 hours. We recommend recharging duration of 7 to 9 Hours for Temperature climate and 10 to 13 hours for tropical Climate.

#### Governing specification :

a. IS-5154 (Part-1) : 2013 Indian Standard, Identical with IEC-60254-1 : 2005 titled "General Requirement & Methods of Tests (Second Revision) And

B. IS-5154 (Part-2) : 2013 Indian Standard, Identical with IEC-60254-2 : 2008 titled "Dimension of sales and terminals & marking of polarity of cells "Second Revision

### Charging according to DIN41774 (Wstandard):

The charger output would depend on the available time in hours and also on the climatic conditions. These are given below:

This out - put is the max, charging current at the start, and the charger should incorporate the current tapering mechanism, so that during gassing period the currents are lower.

Recharging time in hours	Charger output Amperes
For Temperate Climate	
7	$\frac{C5 \text{ Ah}}{4.5}$
8	$\frac{C5 \text{ Ah}}{5.9}$
9	$\frac{C5 \text{ Ah}}{7}$
For Tropical Climate	
10	$\frac{C5 \text{ Ah}}{7.8}$
11	$\frac{C5 \text{ Ah}}{8.5}$
12	$\frac{C5 \text{ Ah}}{9.3}$
13	$\frac{C5 \text{ Ah}}{10}$

Starting voltage on charge 2.0V Per Cell.

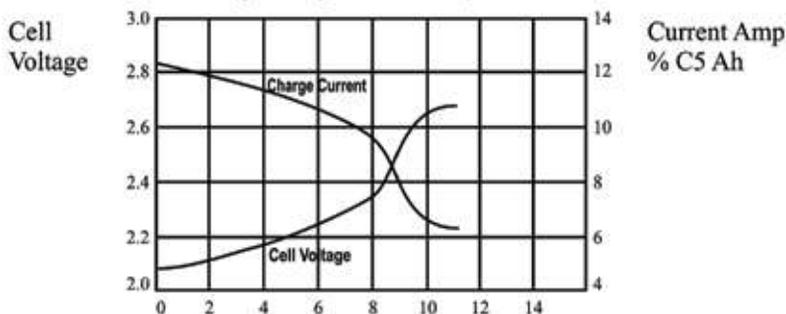
Example: For a charge time of 12 hours with a battery capacity of 930 Ah, the size of the charger required is:

$$\frac{930 \text{ Ah}}{9.3} = 100 \text{ Amp output}$$

This is also illustrated in the following diagram for guidance, for tropical and temperate climate.

### Typical Recharge Characteristics

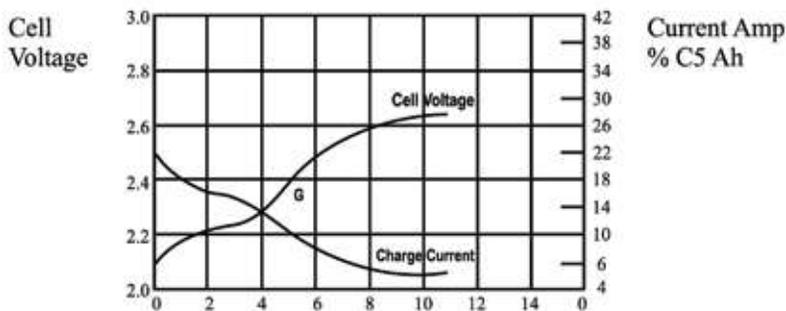
From a single Rate taper Charger  
 (Cells discharged to the extent of 100% C5 Ah  
 electrolyte temperature 30°C)



HOURS  
 Charge Current 12.5% C5/6% C5  
 Charging Time 10 Hours  
 G-Gassing Point

### Typical Recharge Characteristics

From a single Rate taper Charger  
 (Cells discharged to the extent of 100% C5 Ah  
 electrolyte temperature 30°C)



HOURS  
 Charge Current 22% C5/6% C5  
 Charging Time: 7 Hours  
 G-Gassing Point

## **Recommended Practice of Maintenance:**

Only fully trained operatives should be responsible for the maintenance of batteries. Recharge the battery immediately after each discharge. Add only distilled or demineralised water for topping up.

**NEVER ADD ACID TO THE CELLS.**

Keep top of the battery and tray clean & dry. Should there be corrosion of the metal work, remove the product of corrosion and neutralise any remaining acid with a solution of sodium bicarbonate or dilute ammonia. Protect it from further corrosion by painting with anti acid paint.

## **Recommended Checks:**

**Daily:** Recharge the battery as soon as possible after discharge. Check that the charger is functioning correctly. Check sp. gr. & temperature of each cell.

**Weekly:** Check the electrolyte levels in each cell & top up if necessary. Topping should be carried out during the last stages of charging. Top up to the correct level. Use approved distilled or demineralised water as per BS 4974 / IS : 1069 : 1993 or latest issue. Watch out for any cells that are taking too much or too little water.

Check all connections and repair any loose wires and worn insulation.

Coat all terminals with petroleum jelly.

Ensure that the top of the battery is clean and dry.

Should there be any corrosion of metal work, scrap it off, neutralise with a solution of water and baking powder or washing soda or dilute ammonia and cover with acid resistant paint.

**Monthly:** The readings of sp. gravity, voltage, temperature and the water consumption during topping would serve as a useful monitor of the state of battery.

## **Disposal of Old Batteries:**

Careless disposal of a battery can harm the environment and be dangerous to persons. Always ensure that batteries are disposed off through an authorised dealer. Never attempt to open a battery or dismantle a cell.

## FAULT FINDING & TROUBLE SHOOTING

The following chart will assist you in recognising symptoms of trouble early, diagnosing the cause and applying proper remedy.

SYMPTOM	PROBABLE CAUSES	REMEDY
<b>A. Battery overheats on discharge</b>	1. Excessive load -Poor Lubrication -tyres under-inflated -brakes dragging	<ul style="list-style-type: none"> <li>• do not overload</li> <li>• lubricate axles</li> <li>• correct inflation</li> <li>• mechanical check</li> </ul>
	2. Low electrolyte levels	<ul style="list-style-type: none"> <li>• top up regularly</li> </ul>
	3. High ambients	<ul style="list-style-type: none"> <li>• provide cooler place for recharging, ventilate when charging or idle</li> </ul>
	4. Battery undersize	<ul style="list-style-type: none"> <li>• Match Capacity</li> </ul>
<b>B. Unequal cell sp. gravities or voltages</b>	1. Over discharging regularly	<ul style="list-style-type: none"> <li>• do not discharge below the recommended minimum sp. gr. readings (Refer page 6)</li> </ul>
	2. Neglect of Equalising	<ul style="list-style-type: none"> <li>• give equalising charge once every month</li> </ul>
	3. Dirty Battery top	<ul style="list-style-type: none"> <li>• clean, wipe dry after charging</li> </ul>
	4. Internal shorts	<ul style="list-style-type: none"> <li>• check weak cell for short circuits, If it runs down regularly. Remove cell, open Lid, check separators etc.repair</li> </ul>
	5. Loss of electrolyte -through spillage -not returning electrolyte drawn by hydrometer into cell	<ul style="list-style-type: none"> <li>• adjust to the recommended fully charged sp. gr. with acid, after equalising charge. (Refer page 5)</li> </ul>
<b>C. Battery overheats on charging</b>	1.Charger setting wrong	<ul style="list-style-type: none"> <li>• lower initial current to recommended value</li> <li>• check and lower clock setting time, if excessive</li> </ul>
	2.Poor ventilation	<ul style="list-style-type: none"> <li>• Open tray cover, use a fan while charging</li> </ul>
	3.Short circuit in cells	<ul style="list-style-type: none"> <li>• identify cell, replace after repairs</li> </ul>
	4.Low electrolyte level	<ul style="list-style-type: none"> <li>• top up with D. M. water</li> </ul>
	5.Sulphated battery	<ul style="list-style-type: none"> <li>• recover by prolonged charges at equalising rate. Correct routine undercharging</li> </ul>

SYMPTOM	PROBABLE CAUSES	REMEDY
<b>D. Battery will not work full shift</b>	1. Undersize battery capacity	<ul style="list-style-type: none"> <li>install correct battery for vehicle and duty</li> </ul>
	2. Battery not fully charged before work	<ul style="list-style-type: none"> <li>Check duty/recharging schedule, do not use partly-charged battery for full stretch of work.</li> </ul>
	3. Adverse working -mechanical defect -electrical defect  -bad roads (friction)	<ul style="list-style-type: none"> <li>check brake, tyres, lubricate truck</li> <li>check motor armature, field for shorts</li> <li>repair track or adjust duty suitably</li> </ul>
	4. One or more cells taken out of battery / shorted	<ul style="list-style-type: none"> <li>replace at the earliest</li> </ul>
	5. Impurities in electrolyte	<ul style="list-style-type: none"> <li>dismantle cells, rinse with distilled water, refill with fresh electrolyte, recharge, adjust sp. gravity</li> </ul>
	6. Short circuit in one or more cells	<ul style="list-style-type: none"> <li>identify by regular low voltage / sp. gr. / high temperature. Remove, repair or replace cells.</li> </ul>
	7. Battery at end of life	<ul style="list-style-type: none"> <li>check by taking a 5 hour discharge. Replace battery if it gives less than 80 per cent of rating.</li> </ul>
<b>E. Low Electrolyte Levels</b>	1. Leaking cell box	<ul style="list-style-type: none"> <li>replace cell box</li> </ul>
	2. Severe overcharging -clock time excessive -clock relay starts later -charger designed for greater output than required	<ul style="list-style-type: none"> <li>lower clock setting.</li> <li>adjust to start at 2.35 volts per cell</li> <li>adjust current to correct initial value</li> </ul>
	3. Neglect of topping up	<ul style="list-style-type: none"> <li>Top up weekly</li> </ul>

## Safety Precautions:

Before Commencing installation, repair or inspection of a battery the person carrying out the work should remove all metallic objects such as rings, wrist watches, neck and wrist chain etc.

Wear protective clothing - rubber gloves and apron and full eye protection using goggles or visor.

Whenever connection or disconnection of batteries or cells is being undertaken, only insulated tools should be used.

Work on batteries should be done with the battery isolated whenever practical, no matter how low the system voltage. This precaution is of particular importance where batteries have a high stored energy.

### Health & safety

When operating batteries it should be noted that not only is there a universal electrical problem of shock or arc burn but three other special hazards:

*(i) Chemical hazard:* eye damage and chemical burns to the skin arising from contact with electrolyte (dilute sulphuric acid).

*(ii) Explosive Hazard:* explosion arising from accidental ignition of the hydrogen/oxygen or hydrogen/air mixture more associated with batteries when on charge.

*(iii) Burn Hazard:* burns to the skin can be caused by contact with metal which has been heated or melted by the application of an unintended electrical current due to the creation of an electrical short circuit e.g. uninsulated tools or other conductive materials bridging the poles of the cell or battery.

### Chemical Hazard-Handling Procedure & Protective Clothing:

Protective clothing should be appropriate the task being undertaken and chemical involved.

**WASHING FACILITIES:** The ease of access to copious amounts of water as a washing facility is important for rapid treatment of acid splashes to the skin.

**EYE PROTECTION:** All personnel working on filled batteries or adjacent to batteries undergoing charge should wear chemical resistant GOGGLES, FACE VISOR or safety spectacles.

Eye wash facilities should be considered as a supplementary precaution if there is doubt about satisfactory discipline in wearing the correct eye protection.

Rubber gloves should be washed after use with soap and water and stored

In certain instances the provisions of a SAFETY HELMET or head protection may be appropriate, in which instance, they must comply with the relevant specification.

It is recommended that RUBBER FOOTWEAR be adopted whenever working on batteries and these are designed to comply with the relevant specification.

PROTECTIVE CLOTHING must be manufactured from waterproof material.

N. B. It is particularly important that it be noted that clothing manufactured from synthetic fibers can generate static electricity and should under no circumstances be used as there is a high risk of explosion if working adjacent to batteries.

***Explosive Hazard:***

Ventilation must be provided in battery charging areas, so as to ensure the rapid dispersal of hydrogen at the maximum rate of production during deliberate or inadvertent overcharging. The number of liters per hour produced under this condition may be estimated by:

maximum current in amperes x 0.42 x total number of cells being charged. Note that oxygen is produced at half this rate.

Natural ventilation is most reliable and therefore preferable. The average hydrogen concentration within the battery room should not exceed 1 %. When it is difficult to provide adequate natural ventilation, a properly designed forced ventilation system should be adopted being either automatic or manual control. (Six air changes per hour shall be the exhaust fan capacity.)

Batteries give off an explosive oxy - hydrogen gas during charging and also, to a lesser degree, under other conditions, especially if the cells are knocked or shaken. It is, therefore, imperative that naked flames, cigarettes or sources of electrical sparks be kept away from the battery room.

***Burn Hazard:***

Accidents are best prevented by electrical isolation of the battery where practicable. Use insulated tools and spanners when working on or near batteries and remove metallic rings and watch bands.

### **Charges in a Ventilated Area Avoid Sources of Ignition:**

The immediate vicinity of the battery should be treated as a Zone 1 Flameproof Area, within reasonable and practical definition. The size of the zone depends on the amount of oxy - hydrogen that is to be produced by the battery or batteries and degree of efficient natural or forced ventilation.

It is mandatory that there be a total ban on smoking and naked lights/sparks. Explosions should be prevented by paying attention to the prevention of the generation or accumulation of hydrogen, sources of ignition should be eliminated where possible. The wearing of goggles and the provision of washing facilities is in most circumstances an important part of the safe system of work.

### **Recommendations:**

The Factories Act Electricity Regulations And the Electricity at Work Regulations must be complied with and all the detailed maintenance instructions and safety advice itemized above should be followed.

Precautions appropriate to corrosive chemicals must be observed when electrolytes are to be handled or sampled.

#### **Electrolyte Chemicals:**

##### **Sulphuric Acid (used in lead Acid Cells) ( $H_2SO_4$ )**

Lead Acid Batteries contain dilute Sulphuric acid which is both poisonous and corrosive and can cause burns and irritation on contact with skin or eyes. In case of contact, flush immediately and thoroughly with clean water.

Obtain immediate medical attention whenever the eyes are affected.

**ALWAYS WEAR PROTECTIVE CLOTHING AND PROTECT THE EYES IN PARTICULAR BY USING A FACE VISOR OR GOGGLES OF THE RECOMMENDED TYPE.**

### **Chemical Hazard Data:**

To assist in the assessments of the potential hazard to health within the definition of the contract of substance hazardous to Health we offer for your consideration the following advice.

ProductName - battery Acid

ChemicalName - Dilute Sulphuric Acid ( $H_2SO_4$ ) ranging from Sp. Gr. 1.170 to 1.50

Synonyms - Vitriol, Dipping Acid, Hydrogen Sulphate, Spirit of Sulphur, Nordhausen Acid.

Description - A colourless, odourless clear liquid, highly acidic, giving exothermic reaction with water.

Toxic Effect - Corrosive, causes burns.

Human Toxicity - Solution causes burns and permanent visual damage may occur. There is a risk of dermatitis as a result of industrial contact.

Ingestion - Corrosive to all body tissues. Inhalation of vapour from strong solutions may cause serious lung damage. Contact with eyes may result in loss of vision. Spray or mist will attack tooth enamel and may result in their loss.

#### **First Aid:**

**Ingestion** - If confined to the mouth, administer large quantities of water as a mouth wash whilst ensuring it is not swallowed.

if swallowed, dilute with approximately 250 ml water. Do not induce vomiting. Arrange for immediate removal to hospital.

**Inhalation** - Remove the casualty from the source of danger. Loosen clothing. If the casualty is unconscious, place him/her in the recovery position. If breathing has stopped, apply artificial respiration. Any individual who has been rendered unconscious should be seen by a doctor.

**Eye Contact** - Flood the eye thoroughly with large quantities of gently running water or sterile eye-wash solution and continue to do so for 10 minutes, ensure the eyelids are held apart whilst irritation is performed. All eye injuries from chemicals should be seen by a doctor.

**Skin Contact** - Flood the splashed surface with large quantities of running water for 10 minutes or until all traces are removed. Remove all contaminated clothing whilst wearing protective gloves. If necessary seek medical attention.

**Fire Hazard** - Where battery acid is in contact with metals, smoking and naked lights should be prohibited because of the risk of hydrogen evolution, a gas which in certain concentration is explosive.

**Reactivity Data:** Sulphuric acid is highly reactive, especially with alkaline substances. The following chemicals in particular should be avoided.

Acetone in the presence of Nitric Acid, Acetonitrile, Bromine Pentafluoride, 2 - Cyanopropane - 2 - OL, Cyclopentadiene, Metal Acetylides or Carbides, Metal Chlorates or Perchlorates, Nitramide, Nitric Acid in the presence of organic material, Nitrotoluene, Nitro - Benzene, Nitromethane, Permanganates and Phosphorous Trioxide.

Extreme caution should also be employed when adding any quantity of water.

**Handling Precautions Respiratory Protection:** Sulphuric Acid, 9air borne) has an occupational exposure standard (OES) of 1 mg/m<sup>3</sup> (8-hour time - weighted - average) therefore in the absence of adequate ventilation or in the presence of strong acid solutions a respirator should be worn.

**Personal Protection:** Full protective clothing will be worn whilst handling battery acid. This will include goggles that afford total eye protections. An overall with long sleeves, buttoned to the neck will be worn as well as long rubber gloves, a protective apron and suitable acid resistant rubber boots. Any contaminated clothing will be removed and washed before re-use.

**Spillage:** In the event of spilling, wear the full protective clothing as outlined above. Spread Soda Ash liberally over the spilling and mop up, cautiously, with running water. Run this to waste with copious amounts of running water.

**Waste Disposal:** Add in small quantities to a large, stirred excess of water, final concentration not greater than 2%. Neutralize with 5% Sodium Hydroxide Solution (Soda Ash washing soda). Run to waste with copious amount of water.

**Note:-** This information and recommendations contained herein are to the best of our knowledge reliable, and no known relevant information has been omitted.

# union Batteries



- Gebrauchsanweisung beachten.
- Please follow the instructions.
- Se conformer a la notice d' emploi.



- Schutzbrille and Schutzkleidung tragen.
- Use overalls and safety - goggles.
- Porter des lunettes de securite et des vetements de protection.



- keine offene Flamme, Glut oder Funken.
- Cause no open flame, embers or sparks.
- Ni flamme ouverte, ni braises, ni etincelles.



- Explosionsgefahr, Kurzschlusse vermeiden
- Explosion hazard, Avoid short circuits.
- Danger d' explosion, eviter les court- circuits.



- Elektrolyte ist stark atzend.
- Electrolyte is highly corrosive.
- Electtolyte fortement corrosif.



- Transporthinweis beachten.
- Please follow transport instructions.
- Respecter les consignes de transport.





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