FIRST NATIONAL BATTERY

THROUGH CARING WE LEAD

Engineering Note **S1-Q4**

SUITABLE ROOMS FOR STANDBY POWER BATTERIES

For safety reasons, no smoking or naked flames should be permitted in rooms containing Standby Power battery installations.

Batteries of enclosed cells can be housed satisfactorily in almost any reasonably well-ventilated and -illuminated room. As the life of a Standby Power battery is heavily dependent upon regular maintenance, this is much more likely to be done effectively if there is easy access to each cell and good lighting. Exposure to direct sunlight, however, is not recommended.

Size of room

When the type and capacity of a battery for a specific duty has been determined, the arrangement of the battery, normally in either a single tier or double tier, should be decided.

Where a detailed arrangement drawing is necessary, it should also indicate not only the size of the room in which the battery is to be housed, but also the types of connections and preferred positions of ancillary equipment required.

Surface finish of floors

An acid-resistant floor, surfaced with quarry tiles or similar material, is recommended, in case of a major accidental spillage.

Consideration should be given to the weight of the battery and stand. First National Battery will provide details of the total weight of the battery and the weight carried by each of the legs of the stand. Where less hardy flooring is installed, a large quarry tile under each leg will help to prevent depressions being formed in the flooring under the legs.

Walls

Any conventional building material is suitable for the walls of Standby Power battery rooms. However, any surface liable to flaking should be avoided or painted with a good quality gloss paint.

The colour of any painted surfaces should be light to reflect as much light as possible throughout the room, enabling the visual condition of the cells to be monitored more readily.

Ventilation

The battery room should be sufficiently well ventilated to prevent the accumulation of hydrogen and oxygen given off during recharging.

As hydrogen is lighter than air and is likely to concentrate near ceiling level, air bricks and vents should be sited high up on outside walls and unvented structural pockets in the ceiling should be avoided. Batteries should not be sited in the middle of a building unless special arrangements, such as ducting, are made to pass extracted hydrogen through an outside wall.

The labyrinth type vent plugs on enclosed cells are designed to prevent the release of acid vapour from the cells under normal conditions. With all vent plugs in place and the battery being operated in accordance with manufacturer's recommendations, there is no danger of corrosion of nearby metal surfaces caused by vapour.

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Where cells are accommodated in floor-standing sheet steel cubicles, ventilation should be adequate not only in the room but also in the cubicles themselves to keep hydrogen concentrations below maximum recommended levels.

During normal trickle charge or floating-trickle charge operation at 2,25 volts per cell or less, the amount of gas released from any lead acid cell is insignificant. Only during the final stages of a boost charge, where the cell voltage exceeds 2,30 volts, are appreciable quantities of gas evolved.

Hydrogen Concentration

To ensure that the ventilation of a battery room is adequate to keep the concentration of hydrogen gas within safe limits, it is necessary to be able to calculate the rate of evolution of hydrogen.

Hydrogen is evolved during a recharge or freshening charge of a battery when the voltage rises above 2,3 volts per cell. Then, when the cells are gassing freely, the concentration of hydrogen gas within the battery room should be limited to one percent. This is one-quarter of the normally-accepted safe limit of 4% hydrogen, but the recommended additional safety margin is fully justified by the important functions of Standby Power batteries.

An input charge of 26,7 Ampere hours to a fully-charged cell will liberate 8 grams of oxygen and 1 gram of hydrogen. 1 gram of hydrogen occupies a volume of 11,2 litres.

The formula for calculating the volume of hydrogen evolved from a battery per hour is therefore:

$$\frac{\text{No of cells x charge current x 11,2 litres}}{26,7}$$

= No of cells x charge current x 0,0004195 m^3.

When the volume of hydrogen found by the above calculation is expressed as a percentage of the total volume of the battery room, it is possible to calculate the number of changes of air per hour to keep the concentration of hydrogen below 1%.

Example:

A battery of 120 YCP21AE cells in a double tier, double row terraced arrangement in a room with dimensions 3,65 x 2,12 x 2,4 metres (18,57 m^3). The finishing rate for these cells calls for a charge current of 17 Amperes.

The volume of hydrogen evolved per hour is:

$$120 \times 17 \times 0,0004195 = 0,856\ m^3$$

From the volume of the room (18,57 m^3) it is necessary to deduct the approximate volume of the battery and stand (the volume of the battery plus 20% for the volume of the stand = 2,83 m^3) to arrive at the volume of free air in the room ... 15,74 m^3.

The concentration of hydrogen gas after charging for 1 hour above 2,3 volts per cell would then be

$$\frac{0,856}{15,74} \times 100\% = 5,44\%$$

Therefore, to keep the concentration of hydrogen gas at a maximum of 1%, the air in the room will need changing

$$\frac{5,44}{1}$$

or 5,44 times an hour.

To allow for slight variations from the assumed values, it is recommended that the requirement be increased to, say, six times per hour.

Temperature

A battery will give the best results when working in a room temperature of between

10 °C and 27 °C, but will function satisfactorily in temperatures between -18 °C and 38 °C.

High temperatures increase the capacity of the cells, but decrease the life, while low temperatures reduce the capacity temporarily and have no long-term adverse effect.

The standard capacity rating for a standby battery, as specified in SABS IEC 896-1:1987, is at a temperature of 25 °C and it is therefore advisable that the battery room be kept as near to this temperature as possible. At temperatures below that level the battery may not have sufficient capacity to perform its required duty.

Lighting

For good natural lighting and ventilation, battery rooms should have opening windows high in the walls, with blinds to prevent direct bright sunlight shining on the cells. Clear or frosted glass is preferable to fluted or rippled glass which may cause the sun's rays to be focussed on the cells.

Hot, direct sunlight can cause separators to become bleached.

Artificial lighting should also provide sufficient lighting for cells to be inspected and readings to be taken.

Washing facilities

Washing facilities - hot water, soap and a towel - should be provided in all battery rooms. Operators may, for example, transfer acid to their fingers while taking hydrometer readings. Water is also necessary to deal with acid spillage.

A self-treatment syringe bottle containing a weak saline solution should be kept in the room in case of acid splashed in the eye.

Battery operating instructions

Supplied with the battery, these should be kept handy near the battery, so that they can be read and the recommendations followed.

Battery connections

Connections from the battery, which are usually made of pvc covered copper cable with a cross section sufficient to maintain voltage drops to an acceptable level, are usually terminated at a wall mounted fuse box within the battery room.

From the fuse box, cabling is used to connect to the associated equipment. Alternatively, and depending on the protection within the downstream equipment, cables may be connected to the load directly from the battery terminals.

The ends of all cable connections should be marked with either red or blue pvc tape or paint, to denote positive and negative poles respectively.

Precautions

Signs and notices prohibiting smoke and the use of any naked flame should be displayed on any doors providing access to battery rooms as well as on the walls within such rooms. Doors should be lockable to prevent unauthorised entry.

Legal requirements

The relevant legislation (for example, the Factories Act, local authority regulations and SABS Codes of Practice) should be strictly adhered to at all times.