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ALKALINE ACCUMULATORS

CARE AND MAINTENANCE

Note: This issue, Pages 1-3, supersedes Issue 2, Pages 1-2 dated 28 May 51 and Issue 3, Pages 3-4 dated 6 Sep 57.

NICKEL-CADMIUM TYPE

DELIVERY

1. Alkaline accumulators are dispatched from the maker's works either:—

- (a) filled with electrolyte and partially charged, or
- (b) empty and discharged with the 'electrolyte' in solid form in a separate sealed container.

In both cases the filler apertures are plugged with wooden stoppers which must not be removed until the accumulators are prepared for service.

STORAGE

2. Alkaline accumulators can be stored either filled (in any state of charge) or empty and discharged. If storage time is likely to exceed 18 months it is preferable, but not essential, for the cells to be filled and partly charged. The filler apertures of all cells on long storage must be firmly plugged with wooden stoppers to prevent ingress of air. To meet urgent demands, it is possible to store alkaline cells in a fully charged condition and in this case the filler apertures must not be solidly plugged but the filler caps must be kept closed or vents fitted. As self-discharge is negligible a refreshing charge is not necessary more often than every two years approx. Alkaline cells are however prone to a condition known as 'sleepiness' and may respond to a reconditioning process, see para 12. Cells should be inspected occasionally and topped up, if necessary. Accumulators must be stored in a clean, dry and cool store. MT accumulators may be stored in position on vehicles, either charged or discharged; but for prolonged storage both accumulator supply leads should be disconnected and secured away from the accumulator.

PREPARATION FOR SERVICE

3. (a) Accumulators stored fully charged are ready for immediate service, without further preparation.
- (b) Accumulators filled with electrolyte and partially charged will be prepared as follows:—
 - (i) Remove and discard the wooden stoppers.
 - (ii) Check the level of the electrolyte and if necessary, top up with distilled water.
 - (iii) Charge at normal rate for ten hours or in emergency at a higher rate for a shorter period. If accumulators for MT vehicles are required for urgent service, the time can be reduced to two hours approx, as the vehicle generator will complete the charge.
 - (iv) Clean off and dry the tops of the cells.
- (c) Accumulators which are empty and discharged will be prepared as follows:—
 - (i) Dissolve the potassium hydroxide (KOH) in distilled water in the proportion of four pounds to one gallon of water. A perfectly clean earthenware, glass or iron vessel should be used for this purpose. On no account use a dirty vessel or one made of galvanized or painted iron. Stir thoroughly with an iron or wooden stick until it is dissolved. Allow electrolyte to stand until it has cooled down, then remove any floating scum and correct the specific gravity to 1.190 by adding distilled water and stirring thoroughly.

- (ii) When the electrolyte is ready for use, but not before, remove and discard the wooden stoppers and immediately fill the cells to the correct level.
- (iii) Allow the cells to stand for 24 hours so that the dry plates are thoroughly soaked. In emergency this soaking time may be reduced or even dispensed with. After soaking, check the electrolyte level and correct if necessary, by adding more electrolyte.
- (iv) Charge as detailed in sub-sub-para 3(b) (iii).
- (v) Clean off and dry the tops of the cells.

NORMAL CHARGING PROCEDURE

- 4. (a) Accumulators should be charged, mounted in their wooden crates where possible. When charging cells without crates they should be placed on oiled or paraffin-waxed wooden boards or glass sheets and if these are not available, wooden planks well rubbed with mineral jelly must be used. Individual cells must be separated by a gap of at least half an inch and any cables used must be well insulated, heavy enough to carry the load and fitted with correct terminations.
- (b) Accumulators and cells on charge must be connected in series and not charged in parallel from the same charging terminals. Each bank or group of series-connected accumulators or cells must have its own separate controlling rheostats, instruments, etc.
- (c) Filler caps or vents must remain closed and in position during charge and at all times, except when checking the specific gravity or topping up. Solid stoppers must be removed before commencing to charge and not replaced until 24 hours after the end of the charge. In emergency, solid stoppers may be replaced before 24 hours have elapsed provided that the accumulator is first discharged to about nine tenths of its capacity.
- (d) Check the electrolyte level and top up, as necessary, with distilled water.
- (e) Charge at the normal rate for seven hours (ten hours for the first charge after storage or delivery) or at a higher or lower rate for a proportionally shorter or longer time.
- (f) The specific gravity does not vary with the state of the charge and gassing occurs during the whole of the charge. The specific gravity and gassing do not therefore give any indication of the state of the charge. At the end of the charge the voltage at normal charging rate will rise to about 1.7V per cell and the accumulator is considered to be fully charged when this has remained constant for about one and a half hours.
- (g) Occasional overcharging does not, in general, damage an alkaline cell, and in cases of doubt a slight overcharge may be given. An alkaline accumulator can withstand a full charge at intervals, without damage, irrespective of its state of charge at the commencement.

DISCHARGING

5. The normal rate of discharge which is given with each accumulator is based on the capacity. Widely differing rates can be safely employed, the limiting factor being the temperature of the accumulator, which should not be allowed to exceed 50°C (120°F). An accumulator is fully discharged

when the voltage falls to about 1.1V per cell at normal discharge rate. At higher discharge rates the voltage will be lower.

SERVICING

- 6. (a) Maintain the level of the electrolyte above the top of the plates. Distilled water only must be used unless the electrolyte has been spilt, in which case, top up with electrolyte of the correct specific gravity. In an emergency, if distilled water is not available rain water or drinking water may be used. Take care not to overfill or spill or splash water on the cell tops or between the cells.
- (b) Keep the cells and crates clean and dry at all times. The cells should be removed from the crates as necessary, for cleaning. When electrolytic action has begun to erode the steel container of a cell, action must be taken as follows:—
 - (i) Fit rubber or wood plug (originally supplied), to prevent splashing or spilling.
 - (ii) Remove the black protective paint from the whole container by brushing with naphtha. Then thoroughly clean and dry.
 - (iii) Wire brush the affected area only, until bright metal is visible.
 - (iv) Apply the primer, then give the whole container three coats of finishing paint (allow each coat to dry for 12 hours approx.).
 - (v) Materials required for painting are as follows:—

*V*AOS,
*S*ection

*P*art No

*D*esignation

H 1(b)	—	Naptha
H 1(a)	8010-99-942-1196	Paint, priming, for paint, finishing, acid and alkali resisting, brushing
H 1(a)	8010-99-942-1197	Paint, finishing, acid and alkali resisting, brushing, black
H 1(a)	8010-99-942-1198	Paint, finishing, acid and alkali resisting, brushing, signal red

- (c) The correct specific gravity of the electrolyte in new cells at 60°F is 1.190 ± 0.010. At other temperatures, the specific gravity reading must be corrected by adding 0.0005 to the specific gravity reading for every 2°F the electrolyte is above 60°F, or by subtracting 0.0005 for every 2°F the electrolyte is below 60°F. The corrected reading must lie between the limits 1.190 ± 0.010. The specific gravity will gradually fall over a period of years to a lower safe limit of 1.150 at 68°F and when this occurs the electrolyte must be drained from the cell and replaced with fresh electrolyte.
- (d) Electrolyte renewal is necessary at very infrequent intervals unless badly contaminated by impure topping-up water. To renew the electrolyte proceed as follows:—
 - (i) Completely discharge at the normal rate to about 0.80V per cell.
 - (ii) Empty out the old electrolyte, taking care not to shake the cells. Do NOT WASH OUT THE CELLS.

Note: These Pages 3-4, Issue 5, supersede Page 3, Issue 4, dated 11 May 62. Para 17 has been added.

- (iii) Refill immediately to the correct level with new electrolyte, specific gravity 1.190, previously prepared, see sub-para 3(c).
- (iv) Recharge, see sub-sub-para 3 (b) (iii).

PRECAUTIONS

7. The electrolyte is a caustic solution. It is corrosive, particularly to the skin and clothing, although it has no action on iron, rubber, ebonite or porcelain. Every precaution must be taken when filling the cells or mixing the electrolyte to avoid contact with the skin or clothing. Should this occur, wash off immediately with water and as an antidote, apply boracic powder to the skin or clothing. For the eyes, first wash thoroughly with water and then use an eyewash made by dissolving one teaspoonful of boracic powder in a pint of water. Where possible, boracic powder should be available when electrolyte is being used.

8. Naked lights must never be used to examine the accumulator.

9. Acid will completely destroy an alkaline accumulator. NEVER USE LEAD-ACID ACCUMULATOR ELECTROLYTE IN AN ALKALINE ACCUMULATOR, or use any utensils or hydrometers for an alkaline accumulator which have been used for lead acid batteries.

10. Do not allow tools or metallic objects to rest or fall on the tops of accumulators.

TRANSPORT

11. Alkaline accumulators will normally be transported as at sub-para 1(a) when overseas shipment is not involved or as at sub-para 1(b) for overseas shipment. When it is necessary to empty cells for transport, they must be completely discharged before emptying and the filler apertures firmly plugged with wooden stoppers immediately they are emptied. Alkaline accumulators may be stored and transported partially or fully charged. Where public or contractor's transport is involved, it is preferable to transport the accumulators in a partially charged condition, since this permits the filler apertures to be plugged with wooden stoppers. Fully charged cells, which must not be solidly plugged, should be transported in Service transport only.

SLEEPINESS

12. After storage, a loss of capacity may be observed in some alkaline accumulators. This condition, known as 'sleepiness' may occur whether the accumulators are stored filled or empty. Accumulators which have been stored for less than six months will not normally be affected and will be prepared for service as detailed in sub-para 3(a) or (b). Whenever possible, all other accumulators must be checked for serviceability as detailed in para 13 and 14 before being taken into service.

TREATMENT OF EMPTY DISCHARGED ACCUMULATORS

13. A developing treatment for accumulators, received empty and discharged is usually specified by the manufacturer. A typical treatment, as follows, can be used as a guide when other instructions are not available:—

- (a) Fill the accumulator, see sub-para 3(c).

- (b) Charge at rated current (5 hour rate) for approximately three times as long as is necessary to give full Ah capacity, eg, 15 hr at 15A for 75Ah accumulator. Discharge at half the charging current for 5 hours. Top up with distilled water.
- (c) Repeat the charge/discharge cycle, see sub-para (b).
- (d) Repeat the charge. Discharge at half the charging current to 1.10V per cell and note the time taken. Calculate the Ah capacity.
- (e) If the Ah capacity on discharge is above that specified in the Inspection Standard (or above 80% of the rated capacity where acceptance figures are not available) the accumulator is serviceable. Repeat the charge and top up with distilled water.
- (f) If the capacity is below the required figure, repeat the charge/discharge cycle, see sub-para (d). If there is no increase in capacity then the accumulator is unserviceable. If there is an increase in capacity, the accumulator may respond to further developing treatment. Repeat the procedure detailed in sub-para (b) to (e) up to three times before sentencing the accumulator as unserviceable.

TREATMENT OF FILLED AND PARTIALLY CHARGED ACCUMULATORS

14. These accumulators will be treated as follows:—

- (a) Charge fully as detailed in the instructions. See Pwr J 605 if instructions are not available.
- (b) Discharge at half the charging current to 1.10V per cell and note the time taken. Calculate the Ah capacity.

Note: Accumulators stored filled and partially charged may not give full capacity after the first charge.

- (c) If the Ah capacity on discharge is above that specified in the Inspection Standard (or above 80% of the rated capacity where acceptance figures are not available) the accumulator is serviceable. Repeat the charge and top up with distilled water.
- (d) If the capacity is below the required figure, repeat the charge/discharge cycle. If there is no increase of capacity, the accumulator is unserviceable. An increase in capacity indicates that the accumulator may respond to further treatment. Repeat the charge/discharge cycle up to three times before sentencing the accumulator as unserviceable.

REPLACEMENT OF CELLS

15. Check the individual cells of accumulators which fail to reach the required standard. Replacement of a poor cell or cells may enable the accumulator to develop the necessary capacity.

INSPECTION

16. Alkaline accumulators held in store, or on equipments not in regular use, must be checked for capacity at intervals of 6-12 months. Charge the accumulator at the normal rate for 15 hours and then discharge at its rated current for 5 hours, to determine the capacity. Proceed as detailed in sub-para 14 (c) and (d).

TRANSPORTATION BY AIR

17. To comply with Air Ministry regulations concerning transport of hazardous freight in transport aircraft, the following conditions will be observed:—

- (a) Accumulators ready for use (filled accumulators installed in vehicles and equipments ready for use):—
- (i) Accumulators are to be fitted with non-spill vents and rubber caps. Part No LV6/MT1/WPG/5197.
 - (ii) Accumulators must be fully charged, but not gassing.
 - (iii) Before loading into aircraft, all accumulators are to be visually inspected and any having cracks, damage to cells or incorrect level of electrolyte should be excluded.
 - (iv) Accumulators must be securely mounted.
- (b) Additional filled accumulators carried in vehicles:—
- (i) (ii) (iii) as in sub-para (a).
 - (iv) Each accumulator is to be encased in acid resistant polythene and sealed with cellophane in such a way that the sealed joint is at the top.
Part No are:—
Polythene film 0.005 in. H4/HD/13458

Tape, adhesive, transparent 1½ in. wide
H4/HD/13611

- (c) Filled accumulators required for replacement purposes:—
- (i) (ii) (iii) as in sub-para (a).
 - (iv) The accumulators are to be packed in wooden cases fitted with battens so placed as to secure the accumulator from movement and leave adequate space for a neutralizing agent to be packed round the accumulator. The neutralizing agent is to be a mixture in the proportion of 10 : 1 by volume of sawdust and boric acid.
Part No:—
Boric acid (56 lb barrel) H1/HA/13803
 - (v) Cases to be marked:—
‘ELECTRICAL ACCUMULATORS
CONTAINING ALKALINE’
and
‘THIS SIDE UP’
 - (vi) The OC unit is to be personally responsible for supervising the crating of all filled accumulators.

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END