alcad

Operating Instructions

for nickel cadmium alkaline Stationary and Marine Batteries

Please read carefully before putting batteries into service

Regular checks maximise their long life.

Its life is now in your hands

Safeguard it by following these simple rules:

1. Ensure that charging is adequate in relation to the duty.
2. Avoid over-discharging.
3. Keep the electrolyte at the proper level by adding pure distilled water only.
4. Keep the cells and crates clean and dry.
5. Keep vent caps closed except when actually topping up.
6. Never put lead battery acid in an Alkaline battery and never use utensils which have been used for lead-acid batteries.

See supplementary instructions when CHARGING AND CONTROL EQUIPMENT is supplied.

Separate instructions for batteries on other applications may be obtained from the Company or its Agents.

CONTENTS

1 Delivery

Batteries are usually delivered in a filled, assembled and discharged condition. In some cases, they are delivered in an empty and discharged condition with sufficient solid electrolyte for first filling, together with full instructions for putting into service. It is essential for batteries delivered empty and discharged to be filled and charged immediately on arrival and not allowed to remain empty. Disregard of this instruction may affect the capacity and future performance. It is equally important that batteries delivered in a filled and discharged condition should have the transit plugs or rubber stoppers removed immediately on arrival (see 3 below) and the batteries should then be charged as soon as possible. If there is likely to be any delay before putting batteries into service the Company or its Agents should be consulted.

2 Unpacking

Keep the crates upright, clean off packing material and examine carefully for damage in transit. Damage or loss should be reported immediately to the carrier, and the Company or its Agents informed that this has been done. See page 5 regarding cells in polystyrene containers.

3 Preparation for service

In the case of batteries delivered filled and discharged, the transit plugs in the steel vents, or the plastic vents, should be loosened to release any accumulation of gas. Turn the face away while releasing gas pressure. After releasing gas pressure remove the transit plugs and/or small rubber stoppers from the plastic vents, but retain them for possible future use.

Batteries should be charged as soon as possible after arrival, but if there is likely to be any delay before putting the batteries into service the Company should be consulted.

Check the electrolyte level in all cells (see section 8) and if it is below plate level in any cell report immediately to the Company or its Agents; minor variations from the correct level should be rectified by the addition of distilled water only. After checking the levels, close the steel vent caps and/or replace the plastic vents less their small rubber stoppers.

In the case of batteries empty and discharged, the electrolyte must be prepared in accordance with the instructions supplied with it, and as given in this booklet on page 11, and the transit plugs or the small rubber stoppers in the vents should not be removed until this has been done. See (1), above, for

the importance of filling and charging immediately on arrival.

Fill the cells to the correct level as given in Tables on pages 15 to 17. Close the steel vent caps or replace the plastic vents, ensuring that the small rubber stoppers from the vent holes have been removed.

4 General installation

Batteries should be installed in a clean, dry and well ventilated place, and, if subjected to dust and dirt, should be suitably protected from it; they should also be placed so that tools and other metallic objects cannot fall on them or touch the sides of the cells.

If installed in a cupboard or cubicle, adequate ventilation must be provided. This is particularly important if atmospheric conditions would produce heavy condensation within the cubicle in the absence of ventilation.

Batteries should not be placed on the floor where they may accumulate dirt and damp; smaller batteries can generally be accommodated on shelves and larger batteries on special stands provided by the Company.

If batteries are on mobile applications where they may be liable to movement in service, they should be fixed firmly in position; if wedges or packing pieces are used these should be placed opposite the crate ends or partitions so as to avoid strain on the crate sides. Such packing pieces must not interfere with the free circulation of air round the battery.

Access to the batteries for topping up and general servicing is preferably arranged from above, but, if it is only possible from the side, at least 12 inches of headroom should be available for this purpose.

Bearing in mind that positive terminals are marked by a + sign or a Red terminal bushing, proceed with installation as follows:

CUBICLE OR BOX

(i) Open lid or doors.

(ii) Place crates therein in correct position for connecting in series, i.e., positive terminal to negative terminal. When cells are fitted with steel vent caps place the crates so that when the vent caps are open they will not be in the way of topping up, i.e., the vent cap hinge must face towards the rear of the cubicle or box.

WOODEN STAND

(i) Place stand or stands in position allocated.

(ii) When porcelain insulators are supplied (90 cells per battery or over), fit these below the legs of the stands ensuring that the projecting pips engage with the recesses in the base of the stand legs.

(iii) Place crates in correct position for connecting in series, i.e., positive terminal to negative terminal. Commence from the middle of the stand and work towards the end.

(iv) When cells are fitted with steel vent caps, place the crates so that when the vent caps are open they will not hinder topping up, i.e., the vent cap hinge must face towards the wall or bulkhead and away from the gangway.

CONNECTING UP

(i) Fit the inter-crate connectors and the inter-tier connector of two-tier arrangements.

(ii) Connect positive and negative terminals of each battery to the main battery leads making sure that these are well secured and of ample length to avoid chafing as well as strain on the terminal sockets.

(iii) Tighten all nuts firmly with a box spanner.

INSTALLATION OF MARINE BATTERIES

(i) Ensure that all crates are securely battened in order to avoid movement. Remember that the crates are also part of the battery insulation and ensure that none of the fixing arrangements are placed so as to produce short leakage paths. This is extremely important on installations over 50 volts, which should preferably be equipped with an earth leakage indicator.

(ii) Provide adequate ventilation to keep battery as cool as possible and prevent accumulation of the gases given off from the battery during charging. Air inlets should be positioned so that salt spray is not drawn in and deposited on the cells.

(iii) Take precautions to avoid heat from exhaust pipes or other hot spots.

(iv) Never use lead-lined trays as lead is attacked by the electrolyte of alkaline batteries.

(v) Keep crates and stillage dry in order to avoid leakage currents and possible earthing of the battery.

(vi) See separate publication, *Marine Engineers' Battery Handbook,* issued by the Company or its Agents.

INSTALLATION OF CELLS IN POLYSTYRENE CONTAINERS

(i) Whilst these cells are by no means fragile, they are of course more easily damaged than orthodox cells in steel containers. Reasonable care in handling during installation and maintenance is important and attention is drawn to the following points:

(ii) When transferring cells from stores to site, adequate resilient packing should be provided to prevent impact damage. Our own practice is to wrap each cell in corrugated cardboard and use wood-wool to cushion the cells should the packing case be dropped or otherwise mishandled. The cells should be transported in an upright position.

(iii) Do not interfere with the small rubber stoppers that are fitted to the vents and secured with adhesive tape until putting into service.

(iv) The cells should be inspected to ensure that the containers are intact and the rubber stoppers removed before placing in position. The top terminal nuts should be checked and tightened down as necessary after coupling the inter-cell connectors ; do not use unnecessary force. Do not interfere with the bottom gland retaining nuts, which are correctly tensioned before the cells leave the works. Never tighten or loosen connectors while the cells are on charge.

(v) Light greasing of the terminals and connectors with Komoline or Petroleum Jelly will guard against atmospheric corrosion and make for easy dismantling should this be necessary.

(vi) Where batteries of more than 12 volts are being assembled from individual cells in plastic containers, care must be taken to avoid the possibility of relatively high voltage, short distance leakage paths. We are always prepared to advise suitable layouts.

When cells in plastic containers are supplied by us assembled in trays, the trays themselves assure sufficient spacing and insulation.

5 First charge

The table on page 13 gives various currents and times to cover the various charging possibilities.

(a) BATTERIES SUPPLIED FILLED AND DISCHARGED

Select, from the table on page 13 the current available and

charge for the appropriate time given in the table for that current.

(b) BATTERIES SUPPLIED EMPTY AND DISCHARGED

Allow the cells to stand for at least 24 hours after filling and adjust electrolyte levels in accordance with the instructions on the electrolyte drum before commencing to charge.
Select, from the table on page 13 the current available and charge for twice the appropriate time given in the table for that current.

During charging do not allow the electrolyte temperature to exceed 45°C. (113°F.). Check the electrolyte levels after charging and adjust if necessary before putting the battery into service.

6 Charging and discharging at normal temperatures

15°C. (59°F.) to 30°C. (86°F.)

(a) BATTERIES ON OPEN CIRCUIT PLUS MANUAL CHARGING

Once every 6 months charge in accordance with the appropriate current and time selected from the table on page 13. If there is an intermittent load on the battery, e.g., switch closing, the appropriate manual charge should be given monthly instead of six-monthly.

(b) BATTERIES ON FLOAT PLUS MANUAL CHARGING

The float charger should be set and periodically adjusted to a voltage equivalent to 1.4 volts per cell, at which figure there will be a small input to the battery. This is, however, insufficient to replace major discharges completely and it is essential once a month to charge batteries at the appropriate rate and time selected from the table on page 13.

(c) AUTOMATIC CHARGING

Owing to the many varieties of Automatic Chargers available, the company's engineering staff should be consulted about these.

(d) BATTERIES ON DISCHARGE AND CHARGE CYCLES

Do not discharge below 1.1 volts per cell at the 5-hour rate or appropriately higher end voltages at lower rates of discharge. Discharged batteries should, as soon as possible, be recharged at normal current for 7 hours or the appropriate current and time selected from the table on page 13.

If in doubt, always be generous.

Cells in 'LR', 'DL', 'XL' and 'PDL' series are designed for heavy momentary discharges or occasional sustained discharges, such as may occur in the case of emergencies. They should not be applied to services where the primary duty is regular cycles of charge and discharge. For such services cells in 'FA', 'TV', 'SV' and 'PSV' series should be used.

7 Temperature

As temperature rises the charging process becomes less efficient, and self discharge increases with the result that batteries at high temperatures tend to be in an undercharged or overdischarged condition. This is easily avoided by proper charging arrangements which must ensure a greater proportion of input over output than recommended for normal temperature operation. A reasonable water consumption, as indicated in section 8, is the best guarantee that batteries are being correctly charged.

8 Checking electrolyte levels and topping up

Cells must be topped up as often as necessary to prevent the electrolyte falling below the tops of the plates. The frequency of topping up is governed by the nature of the duty cycle and can only be determined by experience.

Excessive consumption of water indicates over-charging or operation at too high a temperature and negligible consumption of water, with batteries on continuous low current or float charge, indicates under-charging. A reasonable consumption of water is the best indication that a battery is being operated under healthy conditions. Any marked change in the rate of water consumption should be investigated immediately.

The following is a rough guide to the frequency of level checking and topping up at normal temperatures.

Batteries on open circuit with six-monthly manual charge.

Check level in pilot cells at time of each six-monthly charge. Water consumption should be small.

Batteries on open circuit or float with monthly manual charge.

Check level in pilot cells at time of each monthly charge. There should be slight consumption of water but battery should not need topping up between monthly charges.

Batteries on automatic float charge with six-monthly manual charge.

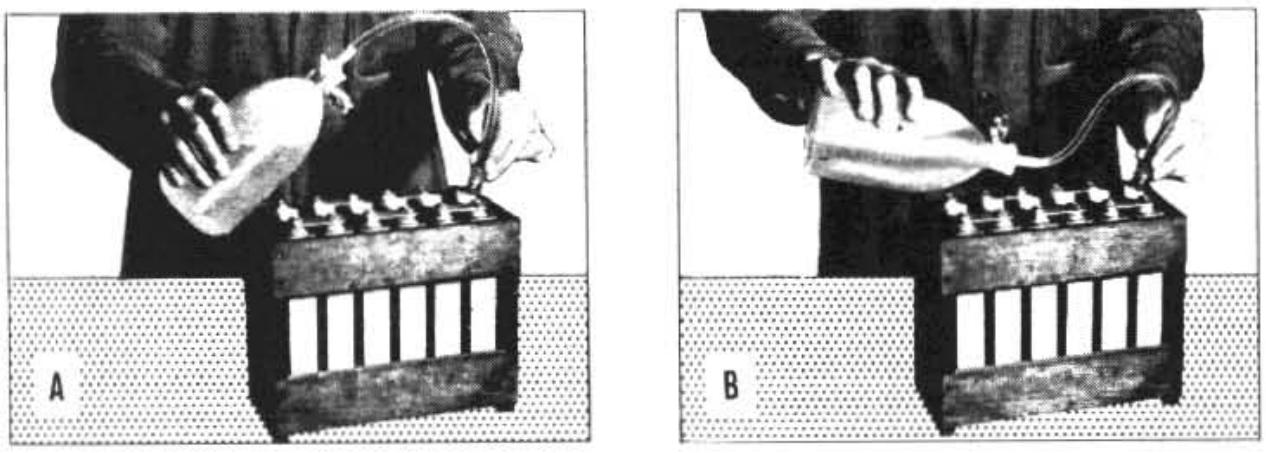
Check level in pilot cells at three-monthly intervals. There should be slight consumption of water and, according to the duty, the battery will need topping up at three- to six-monthly intervals.

Only pure distilled water must be used for topping up and the electrolyte level must never be allowed to fall below the top of the plates – the nearer it can be kept to the correct level the better. Do not fill above the correct level as this may cause loss of solution, necessitating too frequent renewal and damage to the battery through external damp and leakage currents.

Always top up before charging so that subsequent gassing mixes the solution ; never check levels or add water during or immediately after charging because the gas in suspension at this stage gives false readings.

SMALL AND MEDIUM INSTALLATIONS (Plastic Bottle Type PB4)

Where only one or two small batteries are involved, topping up can be done with a jug and funnel or a syphon hydrometer (Part No. 65002), and the level checked with a plastic level testing tube (Part No. 65475). Where numbers of batteries are involved, the plastic bottle type PB4 should be used. This bottle is specially designed to work in conjunction with our patented plastic vent, the combination enabling topping up to be done without removing the vents. The system is clean and speedy and automatically tops up to the correct level.



Plastic Bottle Type PB4 in use

Ensure that the appropriate nozzle is fitted to the bottle (see table, page 9) and fill to about 2 in. below the mouth of the bottle with pure distilled water. Hold the bottle as in position A, compress it gently and then insert the nozzle to the full extent through the hole in the plastic vent. Now release the pressure and if liquid is withdrawn into the plastic tube it, indicates that no topping up is required. Return the extracted liquid to the cell by gently compressing the bottle. If, however, no liquid is withdrawn the cell requires topping up as follows :

Hold the bottle in position B, as close to the level of the cell-tops as possible, and compress gently to inject a little water into the cell. Release pressure to allow withdrawal of air. Continue to compress and release gently until a solid column of liquid appears in the tube permeated with a continuous stream of small air bubbles. The cell is now topped up to the correct level.

Return the bottle to position A and compress to empty tube and avoid dripping water between cells.

Although primarily designed for use with the plastic vent fitted to small cells, the bottle may equally well be used on larger cells fitted with steel vents, provided, of course, that such cells are not so large or so numerous as to require too frequent replenishment of the bottle. Appropriate nozzles (see table, below) are provided for use with the various ranges of steel-vented cells and the method of use is exactly as described above.

	With Bottle PB4 use	
For cell types	**Nozzle No.**	**Part No.**
TV12–30, SV12–54,	2	83252
DL5–45, FA1–5	2	83252
TV6–11, SV6–10	3	83253
XL1–4	3	83253

LARGE INSTALLATIONS (Electric Filler Type E)

As the size or number of cells increases, a point is reached where it is inconvenient for the operator to carry the quantity of distilled water, as in the plastic bottle, and some form of fixed or semi-portable installation is necessary. The filling apparatus type E has been specially designed to meet this requirement. The supply of distilled water is in a 2-gallon plastic container which is placed or suspended above the battery, so that the water flows by gravity to the filling pistol which is controlled by a lever-operated valve. When it is not convenient to use a gravity feed, a 2-gallon pressure tank is available as an alternative to the 2-gallon plastic container. On opening the valve water flows into the cell until, when the electrolyte reaches the nozzle tip, an electrical circuit is completed. The circuit consists of a small battery, a relay and a buzzer. On completion of the circuit the buzzer sounds, warning the operator to release the lever to cut off the flow of water.

The correct height of solution for different types of cell is determined by the length of the detachable distance bush – see table below.

	With Electric Filler Type E use	
For cell types	**Bush Marked**	**Part No.**
TV12–30, SV12–54, DL5–45	C	83125
TV6–11, SV6–10	B	83124

VERY LARGE INSTALLATIONS (Power-operated Filler Type PF)

Where the consumption of water is very large, it is advisable to increase the speed of the topping up process without loss of accuracy or cleanliness. For this purpose we have provided a power-operated topping up set, type PF.

This set uses a pressure sensitive filling pistol and instead of the water being gravity-fed to the pistol, it is supplied at speed under pressure by a small electrically-driven pump. The speed of operation has proved to be a substantial labour-saver where considerable quantities of water have to be used. Full details of this equipment are freely available on request.

STORAGE OF DISTILLED WATER

The 2-gallon plastic container (Part No. 83231), part of the type E equipment, is available separately and is ideal for the storage of distilled water. It can be suspended from a hook to save floor space, and does not suffer from the effects of rust or corrosion normally associated with metal containers.

9 Cleanliness

Dirt and damp cause current leakage and therefore cells and crates must be kept clean and dry; battery compartments must have adequate drainage, and dirt must not be allowed to accumulate on the cell tops or on the bosses and insulators. Any dirt collecting between the bottoms of the cells and the crate or battery compartment must be cleaned out periodically.

The terminals and connectors, and the tops of the cells, may be kept lightly greased with Komoline if they are particularly subject to corrosive atmospheres.

10 Specific gravity

This should be checked every 12 months; it does not vary with the state of charge but falls gradually in service.

The normal gravity is 1.190 and cells should not be operated with the gravity below 1.160 or above 1.200. These

figures apply only when the electrolyte stands at the correct level over the plates. Readings should not be taken immediately after topping up, but only when the electrolyte has become thoroughly mixed by a few hours charging and then allowed to stand for some time to allow the gas to disperse.

The above specific gravity figures are for an electrolyte temperature of 20°C (68°F). At other temperatures a correction is necessary in accordance with the following table:

9°C. (48° F.)	20°C. (68°F.)	31°C. (88°F.)	42°C. (108°F.)
1·205	1·200	1·195	1·190
1·195	1·190	1·185	1·180
1·185	1·180	1·175	1·170
1·175	1·170	1·165	1·160
1·165	1·160	1·155	1·150

For electrolytes at intermediate temperatures use the nearest given temperature in table above. Low gravity must not be corrected by the addition of electrolyte, but when the lower limit is reached the electrolyte must be changed completely. This may only be necessary once or twice in the life of the battery according to the duty. If temperatures below 9°C. (48°F.) are likely to be encountered, seek the advice of the Company, or its Agents.

11 First filling, changing the electrolyte and general overhaul

See safety precautions on inside back cover.

Only use the liquid or solid form electrolyte supplied by the Company or its Agents. The material and the solution made from it are both highly corrosive and must not come in contact with the clothes or fingers; only plain iron or porcelain vessels must be used for mixing and filling; do not use copper, aluminium, galvanised vessels or vessels with soldered joints.

Full instructions for first filling or changing the electrolyte are supplied with each consignment, but the essentials are as follows:

Batteries supplied discharged and empty will be ready for filling after removal of transit stoppers. When changing electrolyte first completely discharge the battery at normal rate to about 0·8 volts per cell. If the cells and crates are clean and easily handled the cells may be emptied without dismantling the crates, but if the cells and crates are dirty it is preferable to dismantle. In dismantling take care not to disturb the steel nuts under the connectors as these control the tension on the leak-proof gland. Any incrustation on the cell tops is best removed with warm water only. Do not shake

during emptying and do not wash out with water. Allow to drain for about 30 minutes – not more – and immediately refill with new electrolyte to the correct depth (see pages 15–17).

Electrolyte is made from solid material as follows:

After making sure that the mixing receptacle is perfectly clean, dissolve the material in the proportion of $4\frac{1}{4}$ lb. of solid to 1 gallon of distilled water. The whole contents of the drum must be dissolved at one time. Stir the solution well, allow to cool thoroughly and remove any floating scum. Stir thoroughly and check the specific gravity – this will be high, and small quantities of distilled water must be added and well stirred until the specific gravity is brought to the correct figure of 1·200 for first filling of new cells, and for renewal electrolyte (except PSV and PDL where correct figure is 1·160).

After changing the electrolyte, dry the cells, thoroughly clean the terminals and tighten the gland nuts as necessary. If the cells have previously had a painted finish the old paint should be removed, the cells thoroughly cleaned and repainted with Celvar alkali-proof paint.

As the crates are also the battery insulation, any cracked or worn or damp softened parts should be replaced and the crates repainted with Creocel alkali-proof paint. Replace any vent caps, gland washers or suspension insulators that are worn or damaged.

Clean all connectors thoroughly and renew where necessary.

When the battery has been re-assembled it must be recharged at the appropriate current from the table on page 13 for twice the time given in the table.

12 Storage

Cells can be stored without damage provided that they are filled with electrolyte to the correct level, fully charged and then discharged at normal rate to approximately one volt per cell. The filler openings should be plugged firmly with the transit plugs or the small rubber stoppers should be inserted in the holes of the plastic vents. The level of the electrolyte should be inspected occasionally to make sure the plates are covered to the correct level. The cells should be stored in a cool, clean and dry place. Before returning to service, remove the solid plugs from the filler openings or the small rubber stoppers from the vent holes in the plastic vents, close vent caps and recharge at the appropriate current from the table on page 13 for twice the time given in the table.

CURRENTS AND TIMES FOR VARIOUS CHARGING CONDITIONS

Tapering currents

Starting Current Amp.	End Current Amp.	Time to recharge a flat battery fully (Hours)	Time to recharge battery fully after taper current stabilises (Hours)
C/12	C/20	24	9
C/11·2	C/18·6	21	7
C/10·4	C/17·3	19½	6
C/9·6	C/16	17½	5½
C/8·8	C/14·6	16	5
C/8	C/13·3	14	4
C/7·2	C/12	13	3¾
C/6·4	C/10·6	11½	3½
C/5·6	C/9·3	10	3
C/4·8	C/8	8½	2½
C/4	C/6·6	7	2
C/3·2	C/5·3	5½	1½
C/2·4	C/4	4½	1¼

Constant currents

Current	Time to recharge a flat battery fully (Hours)	Time to recharge battery fully after voltage stabilises (Hours)
C/15	24	9
C/14	21	7
C/13	19½	6
C/12	17½	5½
C/11	16	5
C/10	14	4
C/9	13	3¾
C/8	11½	3½
C/7	10	3
C/6	8½	2½
C/5	7	2
C/4	5½	1½
C/3	4½	1¼

'C' represents the normal rated capacity of the battery in Ampere-hours.
Current values given above are in terms of this, e.g., for a 65Ah. battery C/10 is 6 5 amp.

13 Repairs

Replacements of external parts such as vent caps, terminal nuts, connectors, insulators, etc., are available from the Company or its Agents.

In the event of any repairs appearing necessary, the Company or its Agents should be given details. Suitable advice will be sent immediately. Cells should not be opened except on the advice of the Company or its Agents.

If a container is damaged, keep the plates covered with electrolyte until the cell can be discharged and emptied. Access of air to the plates must be prevented by a solid plug in the filler opening and any holes in the container should be sealed off with Chatterton's compound until repair or replacement can be carried out.

If cells are to be returned in an empty condition, they must be discharged to at least 0·80 volts before emptying, and the filler openings must then be plugged to exclude air. Cells must never be emptied unless they are in a discharged condition. Cells should not be filled with distilled water for transit or at any other time.

TABLES OF CELL DATA

Type of Cell	Capacity at 5 hour rate at 68°F. (20°C.)	Normal Discharge Rate (5 hours)	Charge Rate (Normal)	Level of electrolyte above tops of plates		Quantity of liquid electrolyte per cell		Weight of solid material to make electrolyte per cell	
	Ampere-hours	Amperes	Amp. for 7 hours	Inches	m.m.	Type R Pints	Litres	Type R lb.	Kg.
FA 1	10	2	2	¾	19·1	0·35	0·20	0·13	0·06
FA 1·5	15	3	3	¾	19·1	0·40	0·23	0·15	0·07
FA 2	25	5	5	1	25·0	0·53	0·30	0·20	0·09
FA 3	32·5	6·5	6·5	1	25·0	0·71	0·40	0·27	0·12
FA 4	45	9	9	1	25·0	0·79	0·45	0·30	0·14
FA 5	55	11	11	1	25·0	0·97	0·55	0·37	0·17

Type of Cell	Capacity at 5 hour rate at 68°F. (20°C.)	Normal Discharge Rate (2 hours)	Charge Rate (Normal)	Level of electrolyte above tops of plates		Quantity of liquid electrolyte per cell		Weight of solid material to make electrolyte per cell	
	Ampere-hours	Amperes	Amp. for 7 hours	Inches	m.m.	Type 8 Pints	Litres	Type 8 lb.	Kg.
PDL 2	20	10	4·0	2½	60	1·28	0·73	0·48	0·22
PDL 2·5	25	12·5	5·0	2	50	1·14	0·65	0·43	0·20
PDL 3	30	15	6·2	2	50	1·12	0·63	0·42	0·20
PDL 4	45	22·5	9·2	1½	40	2·58	1·47	0·97	0·44
PDL 6	60	30	12·4	2	52	2·94	1·67	1·11	0·50
PDL 7	70	35	14·4	2	52	2·91	1·65	1·09	0·50
PDL 8	80	40	16·4	2	52	2·93	1·66	1·10	0·50
PDL 10	100	50	20·6	2	52	3·16	1·80	1·19	0·54
PDL 12	120	60	24·6	2	52	3·49	1·98	1·31	0·59

Type of Cell	Capacity at 5 hour rate at 68°F. (20°C.)	Normal Discharge Rate (5 hours)	Charge Rate (Normal)	Level of electrolyte above tops of plates		Quantity of liquid electrolyte per cell		Weight of solid material to make electrolyte per cell	
	Ampere-hours	Amperes	Amp. for 7 hours	Inches	m.m.	Type 8 Pints	Litres	Type 8 lb.	Kg.
PSV 1·5	15	3	3·0	1¾	46	1·07	0·61	0·40	0·18
PSV 2	20	4	4·0	1¾	46	1·01	0·57	0·38	0·17
PSV 3	30	6	6·0	1¾	46	1·10	0·62	0·42	0·19
PSV 4	40	8	8·0	1¾	46	0·97	0·55	0·36	0·16
PSV 5	50	10	10	1¾	46	1·07	0·61	0·40	0·18
PSV 6	60	12	12	1¾	44	2·74	1·56	1·03	0·47
PSV 8	80	16	16	2	52	2·71	1·54	1·02	0·46
PSV 10	100	20	20	2½	63	3·36	1·91	1·26	0·57
PSV 12	120	24	24	2½	61	2·93	1·66	1·10	0·50

PSV and PDL types are in polystyrene containers

TABLES OF CELL DATA

Type of Cell	Capacity at 2 hour rate at 68°F. (20°C.)	Normal Discharge Rate (2 hours)	Charge Rate (Normal)	Level of electrolyte above tops of plates		Quantity of liquid electrolyte per cell		Weight of solid material to make electrolyte per cell	
	Ampere-hours	Amperes	Amp. for 7 hours	Inches	m.m.	Type R Pints	Litres	Type R lb.	Kg.
XL 1	12	6	2·5	1	25·4	0·36	0·20	0·13	0·06
XL 1·5	17	8·5	3·5	1	25·4	0·61	0·35	0·23	0·10
XL 2	22	11	4·5	1	25·4	0·66	0·38	0·25	0·11
XL 2·5	29	14·5	5·8	1	25·4	0·75	0·43	0·28	0·13
XL 3	37	18·5	7·5	1	25·4	1·07	0·61	0·40	0·18
XL 4	46	23	9·5	1	25·4	1·20	0·68	0·45	0·20

Type of Cell	Capacity at 2 hour rate at 68°F. (20°C.)	Normal Discharge Rate (2 hours)	Charge Rate (Normal)	Level of electrolyte above tops of plates		Quantity of liquid electrolyte per cell		Weight of solid material to make electrolyte per cell	
	Ampere-hours	Amperes	Amp. for 7 hours	Inches	m.m.	Type R Gallons	Litres	Type R lb.	Kg.
DL 5	55	27·5	11	1	25·4	0·14	0·64	0·42	0·19
DL 6	65	32·5	13	1	25·4	0·17	0·77	0·52	0·24
DL 7	75	37·5	15	1	25·4	0·18	0·82	0·54	0·25
DL 8	85	42·5	17	1	25·4	0·20	0·91	0·60	0·27
DL 10	100	50	20	1	25·4	0·23	1·05	0·69	0·31
DL 12	120	60	24	1	25·4	0·27	1·23	0·80	0·36
DL 14	140	70	28	1	25·4	0·31	1·41	0·93	0·42
DL 15	155	77·5	31	1	25·4	0·34	1·55	1·01	0·46
DL 17	170	85	34	1	25·4	0·39	1·77	1·17	0·53
DL 19	190	95	38	1	25·4	0·46	2·09	1·37	0·62
DL 21	210	105	42	1	25·4	0·48	2·18	1·43	0·65
DL 23	230	115	46	1	25·4	0·55	2·50	1·65	0·75
DL 25	250	125	50	1	25·4	0·58	2·64	1·74	0·79
DL 27	270	135	54	1	25·4	0·64	2·91	1·92	0·87
DL 29	295	147·5	59	1	25·4	0·72	3·27	2·15	0·98
DL 31	315	157·5	63	1	25·4	0·73	3·32	2·19	0·99
DL 35	350	175	70	1	25·4	0·81	3·68	2·43	1·10
DL 40	400	200	80	1	25·4	0·93	4·23	2·78	1·26
DL 45	450	225	90	1	25·4	1·05	4·77	3·15	1·43

TABLES OF CELL DATA

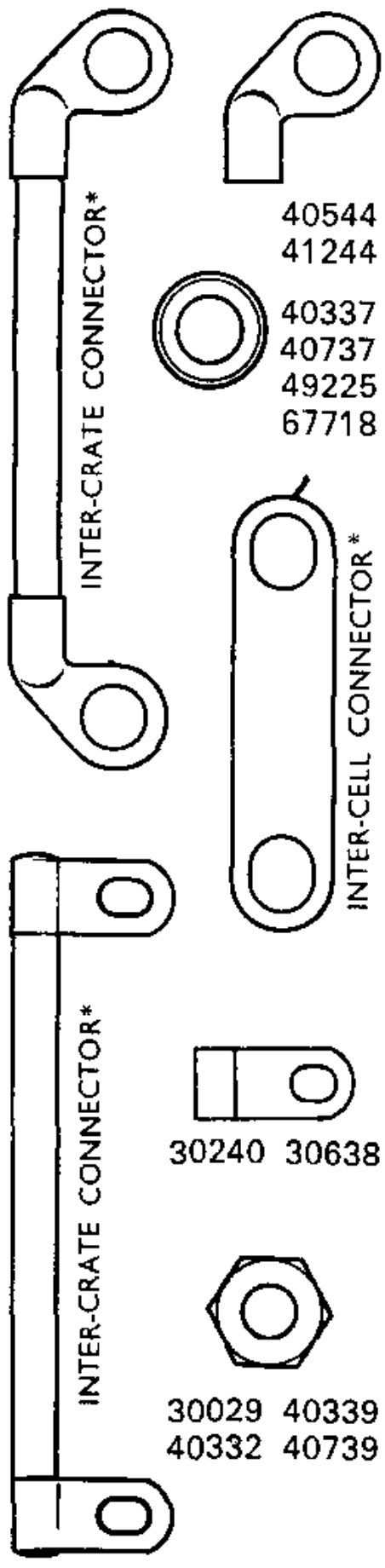
Type of Cell	Capacity at 5 hour rate at 68°F. (20°C.)	Normal Discharge Rate (5 hours)	Charge Rate (Normal)	Level of electrolyte above tops of plates		Quantity of liquid electrolyte per cell		Weight of solid material to make electrolyte per cell	
	Ampere-hours	Amperes	Amp. for 7 hours	Inches	m.m.	Type 3 Gallons	Litres	Type 3 lb.	Kg.
TV 6	65	13	13	1	25·4	0·10	0·46	0·30	0·14
TV 8	80	16	16	1	25·4	0·11	0·50	0·33	0·15
TV 9	95	19	19	1	25·4	0·13	0·59	0·39	0·18
TV 11	110	22	22	1	25·4	0·15	0·68	0·45	0·20
TV 12	120	24	24	1	25·4	0·16	0·73	0·48	0·22
TV 14	140	28	28	1	25·4	0·18	0·82	0·54	0·24
TV 16	160	32	32	1	25·4	0·21	0·95	0·63	0·29
TV 18	180	36	36	1	25·4	0·23	1·05	0·69	0·31
TV 20	200	40	40	1	25·4	0·26	1·18	0·78	0·35
TV 22	225	45	45	1	25·4	0·29	1·32	0·87	0·39
TV 25	250	50	50	1	25·4	0·32	1·45	0·96	0·44
TV 27	275	55	55	1	25·4	0·36	1·64	1·08	0·49
TV 30	300	60	60	1	25·4	0·39	1·77	1·17	0·53

Type of Cell	Capacity at 5 hour rate at 68°F. (20°C.)	Normal Discharge Rate (5 hours)	Charge Rate (Normal)	Level of electrolyte above tops of plates		Quantity of liquid electrolyte per cell		Weight of solid material to make electrolyte per cell	
	Ampere-hours	Amperes	Amp. for 7 hours	Inches	m.m.	Type R Gallons	Litres	Type R lb.	Kg.
SV 6	60	12	12	2	50·8	0·18	0·82	0·54	0·24
SV 7	72	14·4	15	2	50·8	0·21	0·95	0·63	0·29
SV 8	84	16·8	17	2	50·8	0·25	1·14	0·75	0·34
SV 9	96	19·2	20	2	50·8	0·27	1·23	0·81	0·37
SV 10	108	21·6	22	2	50·8	0·33	1·50	1·00	0·45
SV 12	120	24	24	2	50·8	0·34	1·55	1·02	0·46
SV 14	140	28	28	2	50·8	0·39	1·77	1·17	0·53
SV 16	160	32	32	2	50·8	0·45	2·05	1·35	0·61
SV 18	180	36	36	2	50·8	0·51	2·32	1·53	0·69
SV 20	200	40	40	2	50·8	0·56	2·55	1·68	0·76
SV 25	250	50	50	2	50·8	0·67	3·05	2·01	0·91
SV 30	300	60	60	2	50·8	0·81	3·68	2·43	1·10
SV 36	360	72	72	2	50·8	0·93	4·23	2·79	1·27
SV 42	420	84	84	2	50·8	1·04	4·73	3·12	1·42
SV 48	480	96	96	2	50·8	1·16	5·27	3·48	1·58
SV 54	540	108	108	2	50·8	1·27	5·77	3·81	1·73

LIST OF SPARES FOR BATTERIES

Terminal assembly

40335 49223
40336 49224
40735 67716
40736 67717



40544
41244

40337
40737
49225
67718

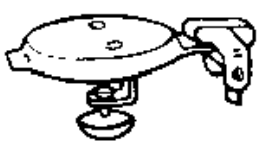
30240 30638

30029 40339
40332 40739

*SPECIFY CENTRES AND CELL TYPE

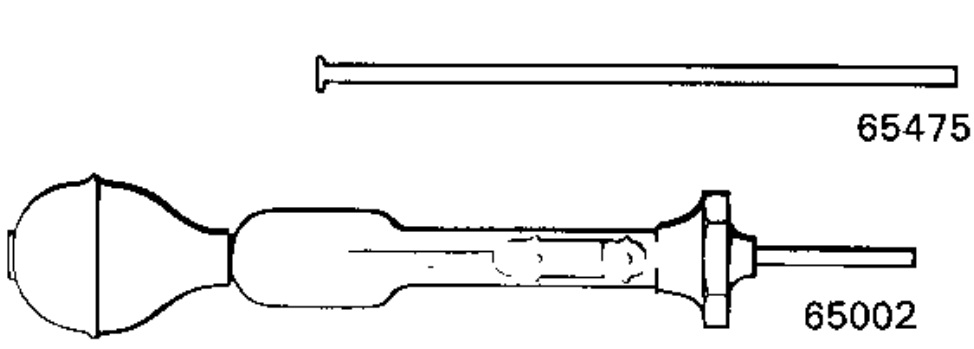
Part No.	Description	Used on cells type
30029	$\frac{1}{4}$″ B.S.F. terminal nut	FA 1 FA 1.5
49224	$\frac{1}{4}$″ gland cap (red)	
49223	$\frac{1}{4}$″ gland cap (black)	
49225	$\frac{1}{4}$″ steel dished washer	
30240	$\frac{1}{4}$″ end lug	
	$\frac{1}{4}$″ intercell connector	
	$\frac{1}{4}$″ intercrate cable connector (up to 12″ centres)	
	$\frac{1}{4}$″ intercrate cable connector (above 12″ centres)	
40332	$\frac{3}{8}$″ B.S.F. terminal nut	FA 2 to FA 5 XL 1
67716	$\frac{3}{8}$″ gland cap (red)	
67717	$\frac{3}{8}$″ gland cap (black)	
67718	$\frac{3}{8}$″ steel dished washer	
30638	$\frac{3}{8}$″ end lug	PSV 1.5 – 5
	$\frac{3}{8}$″ intercell connector	
	$\frac{3}{8}$″ intercrate cable connector (up to 12″ centres)	
	$\frac{3}{8}$″ intercrate cable connector (above 12″ centres)	
69835	$\frac{3}{8}$″ U.N.F. terminal nut	
40339	$\frac{5}{8}$″ B.S.F. terminal nut	TV 6 to TV 11 XL 1.5 to XL 4 SV 6 to SV 54
40337	$\frac{5}{8}$″ steel dished washer	
40335	$\frac{5}{8}$″ gland cap (red)	
40336	$\frac{5}{8}$″ gland cap (black)	
40544	$\frac{5}{8}$″ end lug	PSV 6 – 12, PDL 2 – 3
	$\frac{5}{8}$″ intercell connector	
	$\frac{5}{8}$″ intercrate cable connector (up to 8″ centres)	
	$\frac{5}{8}$″ intercrate cable connector (above 8″ centres)	
87899	$\frac{5}{8}$″ U.N.F. terminal nut	
40739	$\frac{7}{8}$″ B.S.F. terminal nut	DL5 to DL45 TV 12 to TV 30
40737	$\frac{7}{8}$″ steel dished washer	
40735	$\frac{7}{8}$″ gland cap (red)	
40736	$\frac{7}{8}$″ gland cap (black)	
41244	$\frac{7}{8}$″ end lug	PDL 4 – 12
	$\frac{7}{8}$″ intercell connector	
	$\frac{7}{8}$″ intercrate cable connector (up to 6″ centres)	
	$\frac{7}{8}$″ intercrate cable connector (above 6″ centres)	
87665	$\frac{7}{8}$″ U.N.F. terminal nut	

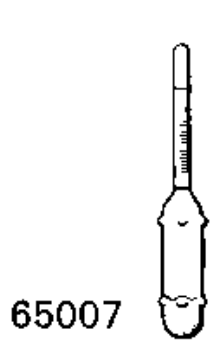
When ordering always quote part number or send sample.

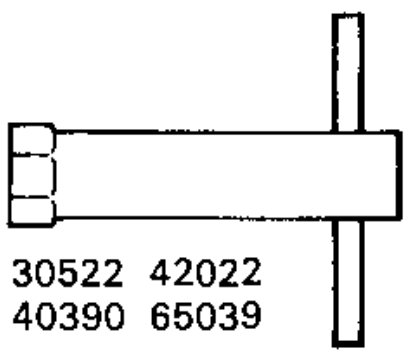
	Part No.	Description	Used on cells type
Vents and filler caps	68179	$\frac{5}{8}$″ plastic vent with seating washer	FA, XL 1 to XL 4, PSV, PDL
	30005	$\frac{5}{8}$″ vent seating washer	
 68179  30005	31172	Small vent cap Parts Group	TV 6 to TV 11 SV 6 to SV 10
	30908	Spring for	
	30917	Hinge Pin for	
 30908 30918 30928  31172 31173 31174  30917 30927	31173	Medium vent cap Parts Group	TV 12 to TV 20 SV 12 to SV 54 DL5 to DL 45
	30918	Spring for	
	30917	Hinge Pin for	
	31174	Large vent cap Parts Group	TV 22 to TV 30
	30928	Spring for	
	30927	Hinge Pin for	
Boss insulators	30045	Small boss insulator	FA 1, FA 1.5
	40345	Large boss insulator	FA 2 to FA 5
 30045 40345 69245	69245	Nylon boss insulator	DL5 to DL 45 TV 12 to TV 30 SV 6 to SV 54 XL 1 to XL 4
Tools and accessories		PB4 plastic topping-up device	
	65039	$\frac{1}{4}$″ B.S.F (and UNF) box spanner	
	30522	$\frac{3}{8}$″ " " "	
	40390	$\frac{5}{8}$″ " " "	
	42022	$\frac{7}{8}$″ " " "	
	65475	Plastic level testing tube	
	65002	Syphon hydrometer complete in carton	
	65007	Hydrometer float	

Fitted Accessory Box

containing syphon hydrometer, box spanner, level testing tube and selection of spare parts. (Type of cell to be specified.)




65007


30522 42022
40390 65039

Komoline

This is a special mineral jelly for greasing steel cell tops, terminals, etc. supplied in standard tins of:

½ lb. (0·23 kg.)
1 lb. (0·45 kg.)
2 lb. (0·90 kg.)
5 lb. (2·27 kg.)

Celvar and Creocel paints

These are special alkali-proof paints. Celvar for repainting the steel cell containers. Creocel for repainting the battery crates and stands; supplied in standard tins, containing approximately:

1 quart (1 litre)
1 gallon (4½ litre)

Renewal electrolyte

For transport over long distances, usually by sea.

Solid electrolyte is supplied and directions for the preparation of it into liquid electrolyte are given on page 12. For the correct type of electrolyte for any cell, see pages 15, 16 and 17.

Solid and liquid electrolytes are supplied in standard non-returnable drums each containing approximately:

Solid	Liquid
½ lb. (0·2 kg.)	1 pint (½ litre)
1 lb. (0·4 kg.)	1 quart (1 litre)
2 lb. (0·9 kg.)	½ gallon (2 litre)
5 lb. (2·3 kg.)	1 gallon (4½ litre)
28 lb. (12·7 kg.)	2 gallon (9 litre)
56 lb. (25·4 kg.)	5 gallon and over (22 litre)

If any further advice or assistance is required please get in touch with the Company or its Agents. Please quote the cell type, battery reference number and date of delivery in correspondence.

Remember that sulphuric acid will destroy any alkaline battery and on no account use utensils which have been used for acid.

Safety precautions

As the steel cell containers are alive, do not allow metal objects to rest across or fall between them.

As, with all accumulators, the gases involved during charging are explosive, never examine with naked lights or do anything likely to cause sparks near the battery.

Do not spill electrolyte on the skin or clothing. In the case of burns immediately cover with boracic powder or a saturated solution of boracic powder. For the eyes wash out with clean water, followed immediately by a solution of boracic powder – one teaspoonful to a pint of water. These should be available whenever electrolyte is being handled, but in an emergency a copious application of clean drinking water will give relief.

When mixing electrolyte from solid material it is advisable to wear protective goggles and rubber gloves.

Note: Never put lead battery acid in an alkaline battery as this will completely destroy it.

Alkaline Batteries Limited

progressive in packaged power

P. O. BOX 4 REDDITCH WORCS. ENGLAND
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Cables : Alkabat Stratford-upon-Avon.

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