AP 120C-0001-1

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BATTERY CHARGING ROOM REQUIREMENTS AND THE MAINTENANCE OF GROUND USE BATTERIES

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

Sponsored for Tri-Service use
by DG Log(Strike)

Prepared by the Aircraft Support Integrated Project Team

Service users should send their comments through
the channel prescribed for the purpose in
JAP 100A-01

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GENERAL AND TECHNICAL INFORMATION

Chapters

PREFACE

1. Each page of this publication bears the date of issue and the current amendment state. Subsequent amendments to the initial issue bear the date and number of the amendment list Sheet with which it is issued.

2. New or amended technical matter will be indicated by a solid black vertical line in the outer margin showing the extent of the amendment. Amendment procedure is detailed in JAP 100A-01.

LIST OF RELATED PUBLICATIONS

Publication	Reference Title
United Kingdom Glossary of Joint and Multinational Terms and Definitions	JWP 0-01.1
Military Aviation Engineering Policy and Regulation	JAP 100A-01
Services Accommodation Code	JSP 315
Manual of Movements	JSP 327
Dangerous Air Cargo Regulations	JSP 335
MOD Health and Safety Handbook	JSP 375
Personal Protective Equipment Catalogue	JSP 437
MOD Hazardous Stores Information System CD ROM	JSP 515
Manual of Movement	JSP 827
The Defence Logistics Support Chain Manual	JSP 886
RAF Manual Fire Services	AP 957
RAF Manual Fire Prevention	AP 3409
RAF Engineering, General Orders and Procedures	AP 100B-01
RAF Logistics Quality Manual	AP 100C-10
Engineering Substances Hazardous to Health	AP 100B-10
The Maintenance Data System Non-Aircraft Work Recording	AP 100C-03
Component Cleaning Processes	AP 119A-0512-1
Surface Finishing Policy, Organisation and Administration	AP 119A-0601-0A
Aircraft Batteries	AP 113C-0001-1
Crimp Splices for Electrical Cables	AP 113D-2008-1
Precautions against Electric Shock in Maintenance Facilities	AP 120A-0001-1
Constant Current Automatic Electronic Charger Type CC 306C	AP 120C-0102-123
Battery Charger Christie Type RF80-K	AP 120C-0113-1
Battery Charger Type 9	AP 120C-0114-1
Battery Charger Type 6, (RN only)	AP 120C-0106-1
Battery Capacity Tester, Richmond Electronics Type 3, (RN only)	AP 120C-0203-1
Battery Capacity Tester, Richmond Electronics Type 2, Mk 3, 230 V, 50 Hz	AP 120C-0206-1
Battery Leakage Tester	AP 120C-0207-1
Crown Fire Standards (Battery Charging Facilities)	Fire Standard F6
Test Equipment Management Asset Tracking System	TEMATS
Technical Procedures for Procurement	Def-Stan 05-123
Marking of Containers for Transportation (General Cargo).	MOD Poster 74

WARNINGS AND CAUTIONS

WARNINGS

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

MAKE SURE YOU KNOW THE SAFETY PRECAUTIONS AND FIRST AID INSTRUCTIONS BEFORE YOU USE A HAZARDOUS SUBSTANCE

READ THE LABEL ON THE CONTAINER IN WHICH THE SUBSTANCE IS SUPPLIED

READ THE DATA SHEET APPLICABLE TO THE SUBSTANCE

OBEY THE LOCAL ORDERS AND REGULATIONS

WARNINGS

(1) WHEN HANDLING OR CARRYING OUT MAINTENANCE ON BATTERIES PERSONNEL ARE TO WEAR PROTECTIVE CLOTHING. REFER TO JSP 437 FOR THE APPROPRIATE PERSONAL PROTECTION.

(2) RECHARGING OF BATTERIES. EXPLOSIVE GASES MAY BE RELEASED DURING CHARGING. CHECK TO BE SURE THAT THE CHARGING AREA IS WELL VENTILATED. DO NOT USE MATCHES OR AN OPEN FLAME IN THE AREA. GUARD AGAINST SHORT CIRCUITS; RESULTING ARCS MAY CAUSE AN EXPLOSION. DO NOT DISCONNECT THE CHARGING CABLE FROM THE BATTERY UNTIL THE BATTERY CHARGER HAS BEEN TURNED OFF AS EXPLOSIONS OR SERIOUS BURNS MAY RESULT. WHEN A BATTERY IS BEING CHARGED, IT SHOULD NOT BE LEFT UNATTENDED.

(3) IF A BATTERY IS REMOVED FROM GSE/MT FOR IMMEDIATE MAINTENANCE THE POSSIBILITY OF THE CELLS BEING PRESSURISED IS TO BE ANTICIPATED; SPURTING OF ELECTROLYTE COULD OCCUR WHEN REMOVING THE VENT PLUGS. VENT PLUGS ARE TO BE LEFT IN PLACE FOR ONE HOUR FOLLOWING REMOVAL OF THE BATTERY FROM GSE/MT.

(4) BATTERY ELECTROLYTE. ELECTROLYTE IS A HAZARDOUS SUBSTANCE. REFER TO THE RELEVANT COSHH ASSESSMENT AND SAFETY DATA SHEET DETAILED IN JSP 515 THE MOD HSIS.

(5) BATTERIES/CONTAINERS ARE HEAVY AND OFTEN CONTAIN DANGEROUS LIQUID. THEY ARE TO BE HANDLED WITH CAUTION; THE USE OF MANUAL HANDLING EQUIPMENT IS RECOMMENDED.

Cautions

(1) BATTERY DAMAGE. De-ionised water is not to be produced in quantity and stored, as carbon dioxide (CO^2) absorption from the atmosphere can, over a long period, have an adverse effect on certain batteries. De-mineralised water is not as pure as de-ionised water and is not to be used in batteries

(2) BATTERY DAMAGE. Topping up of battery electrolyte in sealed lead acid batteries is not possible and must not be attempted.

CHAPTER 1

DESIGN, LAYOUT, EQUIPMENT AND PROCESSES EMPLOYED IN BATTERY CHARGING ROOMS

(Completely Revised)

GENERAL DESCRIPTION

CONTENTS

Figs Page

Tables Page

INTRODUCTION

1. Military Air Environment (MAE) Battery Charging Facilities (BCF) currently charge and maintain the following equipment:

1.1. Flooded (Wet) lead acid batteries - this battery type is decreasing due to the introduction of more of the type described in para 1.2.

1.2. Lead acid, 'Gel' Valve Regulated and Sealed Lead Acid Batteries (VRLA and SLAB) batteries.

1.3. Absorbed Glass Mat (AGM) lead-acid batteries

1.4. Nickel cadmium multi-cell batteries.

NOTE

The batteries described in para 4 emit Hydrogen gas to a greater or lesser degree whilst on charge at suitable constant potential or low rate of constant current; however little or no gassing may be apparent, even though the battery may be known to be fully charged. At higher rates of constant current and at higher than normal values of constant voltage there will be some gassing and consequential water loss. Gassing may occur when a cell is reverse charged either accidentally, or through being over discharged in use, or when the battery is undergoing a capacity test. Gassing normally occurs when being recharged; vigorous gassing usually indicates a healthy cell.

NB Hydrogen forms an explosive mixture in air when its concentration by volume exceeds 4%.

Flooded Lead Acid Batteries

2. The flooded lead acid battery has open-vented cells exposing the active electrolyte and conducting plates. As the batteries reach a charged state the electrolyte heats up and emits hydrogen gas which is produced at a faster rate as a battery reaches a fully charged state. This production increases if the battery is allowed to attain an overcharged state, however this is limited by applying a strict monitoring regime.

Sealed Lead-Acid (SLAB) and Valve Regulated Lead-Acid (VRLA) Batteries

3. Unlike the flooded lead-acid battery, both SLA and VRLA batteries are designed with a low over-voltage potential to prohibit the battery from reaching its gas-generating potential during charge because excess charging would cause gassing and water depletion. Consequently, these batteries can never be charged to their full potential.

Absorbed Glass Mat (AGM) Lead-Acid Batteries

4. The AGM is a sealed lead-acid that uses absorbed glass mats between the plates. It is sealed, maintenance-free and the plates are rigidly mounted to withstand extensive shock and vibration. All AGM aircraft batteries used in the MAE are recombinant, meaning they recombine 99% of the oxygen and hydrogen, there is almost no water loss. The charging voltages are the same as for other lead-acid batteries. Even under severe overcharge conditions, hydrogen emission is below the 4% specified for aircraft and enclosed spaces.

Nickel Cadmium Multi-Cell Batteries

5. In common with the flooded lead-acid battery, these types also produce hydrogen when nearing or at a fully charged state however, the amount of hydrogen produced is much less than that of a comparable capacity flooded lead-acid battery.

DSEAR COMPLIANCE

6. BCF are by their nature zoned environments, yet no manufacturer currently makes a zonally compliant Battery Charger. The safe operation of Battery Chargers requires them to be in close proxinity to the batteries on charge and as such, measures are put in place to maintain a safe operating environment.

7. DSEAR recognise that mitigation measures can be put into place to allow operation in such an environment and the mitigation measures required under MoD regulations are comprehensive. MoD mitigation measures are described in paras 8-17.

8. When designing or redesigning Battery Charging Rooms (BCRs) the Station Works Services is to be consulted, and reference should be made to this publication which is currently the unique source document for the design of Aircraft and Ground Support Equipment Battery Charging Facilities (BCF) in the MAE. This publication mirrors the design requirements of Crown Fire Standard F6 Battery Charging Facilities and supercedes the requirements of DOE/PSE M&E Engineering Guide 7.9 (Ventilation of Battery Charging Rooms), which was cancelled by Defence Estates Technical Bulletin 99/08. This publication should not be confused with Design and Maintenance Guide 13 (Mechanical Transport Facilities) which is primarily concerned with the design and construction of Lead Acid only BCF in the Land Army environment. HSE Publication INDG 139 (Using Electric Storage Batteries Safely) and HSE Leaflet Fire and Explosion Rating have been used as source documents for this publication. It is envisaged that BS EN 50272-1 (Safety requirements for secondary batteries and battery installations. Part 1: General safety information) will supply specific guidance when published; this document is in development and is due to be published in Aug 2010.

MITIGATION AND CONTROL MEASURES

9. HSE Leaflet Fire and Explosion Rating states: 'ventilation, either natural or mechanical (i.e. produced by fans) can both dilute sources of release and remove dangerous substances from an enclosed area. As a result there is a close link between the ventilation at any given location and the classification and extent of a zone around a potential source of release. Well-designed ventilation may prevent the need for any zoned area, or reduce it to a negligible extent'.

10. DSEAR requires control measures to be put in place in order to eliminate the risk or reduce the probability of the risk occurring as far as reasonably practicable and mitigate the risks of any fire or explosion. DSEAR also states that when the risk cannot be eliminated, control measures are to be applied in the following priority order:

The reduction of the quantity of dangerous substances to a minimum:

11. Conformity within the MoD is provided by:

11.1. Using the charging area for charging batteries only and not for storage or any other maintenance activities thereby not impeding the natural circulation of air.

11.2. Providing high and low level extraction and ventilation at a minimum rate of 4 times/hr change of fresh air

Avoidance or minimisation of release of dangerous substances

12. Conformity within the MoD is provided by:

12.1. Providing high and low level extraction and ventilation at a minimum rate of 4 times/hr change of fresh air.

12.2. Constantly monitoring the batteries on charge preventing excessive overcharging of the batteries with the consequent production of high levels of hydrogen

12.3. The use of 'fully controlled charging' i.e. automatically reducing the charging current as the battery approaches a full charged state; thereby reducing the risk of overcharging.

12.4. The use of 0.1c and 0.5c rates of charging, this minimises gassing of the batteries by limiting the charging rate to a tenth or a half of the battery capacity.

Control of release of dangerous substances at source

13. Conformity within the MoD is provided by:

13.1. The use of thermal protection devices fitted to certain alkaline batteries that interrupt the charging current when the battery temperature exceeds a pre-determined limit.

13.2. The shape and size of the charging area; controlled by limiting the use of one battery on charge per charger.

13.3. Training of personnel and their compliance with current technical documents in particular with respect to charging regimes and practices.

13.4. Limiting storage of batteries to those classed as 'mission critical'.

Prevention of the formation of a dangerous atmosphere

14. Conformity within the MoD is provided by:

14.1. Replacing 'wet' lead acid batteries with VRLA and AGM batteries where possible.

14.2. Positioning the battery directly in front of the extraction system vents and limiting the battery/charger ratio in most cases to 1/1.

Collection, containment and removal of any release to a safe place

15. Conformity within the MoD is provided by mechanical ventilation systems installed in accordance with the following requirements:

15.1. Use of fans of the bifurcated axial flow or centrifugal type, with the motor situated out of the contaminated air stream to provide a minimum of four air changes per hour for both lead acid and alkaline batteries.

15.2. Avoidance of discharge from the extractor duct into the prevailing wind.

15.3. Arrangement of outlet vents to give adequate dispersal, to ensure that there is no external detrimental effect.

15.4. Siting of the inlet ducts to the ventilation systems with regard to exhaust fumes given off by aircraft, vehicles or ground support equipment.

Avoidance of ignition sources in zoned areas, in particular those from electrical and mechanical equipment

16. Conformity within the MoD is provided by:

16.1. The banning of naked lights, matches and lighters in BCF.

16.2. The use of spark proof type ATEX Zone 1 rated torches (5A/2596295) and Multimeters (6625-99-4643301) in the vicinity of a battery on charge.

16.3. Locating the starting equipment for the fans externally

16.4. Interlocking of the fan electrical control circuits to prevent operation of the charging equipment unless the extraction system is operating

16.5. The convention that connections are NOT made or broken with the battery charger power switched 'ON'. At the end of the charging period, after switching 'OFF', the charging leads are disconnected first at the battery and then from the supply terminals. Prior to switching the charging board 'ON' or 'OFF' the output control on the charging board is, where possible, turned to the 'ZERO' position.

16.6. The policy that all metal tools long enough to constitute a short-circuiting risk have as much of their surface areas as practicable insulated with rubber or similar sleeving. Tools, hydrometers, syringes and containers are maintained free from acid or alkaline when not in use. Separate items of such equipment are used for the different types of batteries, colour coded to avoid confusion, i.e. RED for lead-acid and BLUE for alkaline. All containers are clearly marked to indicate their contents. Containers for acid are not used, placed or stored in an area where alkaline batteries are maintained or vice-versa.

Avoidance of adverse conditions (for example, exceeding the limits of temperature and control settings) that could lead to danger

17. Conformity within the MoD is provided by:

17.1. Maintaining the temperature of BCRs, where possible, (in accordance with The Workplace Health, Safety and Welfare Regulations 1992) at approximately 16°C. This is the recommended minimum temperature when the BCR is occupied. The maximum permitted electrolyte temperature during charging is 43°C for lead-acid and 49°C for alkaline batteries. However, some batteries of special design have lower limits; the temperature limitations being specified in the associated publication.

The separation of incompatible substances

18. Conformity within the MoD is provided by:

18.1. Separating areas provided for lead-acid and alkaline battery maintenance.

OTHER FACTORS

19. HSE Publication INDG 139 (Using Electric Storage Batteries Safely) suggests that, for ventilation requirements and in most situations, a Zone 1 hazardous area should be considered to exist for up to one metre in all directions around batteries undergoing charging. Reference H also suggests all equipment present within the hazardous zone should be suitable and should be constructed and maintained to the appropriate standard.

19.1. The installation of gas detecting alarms.

CONCLUSIONS

20. It is considered that the MoD approach to ventilation and charging practices enables all but the immediate vicinity of the battery to be identified as non-hazardous, as advocated by HSE Publication INDG 139 (Using Electric Storage Batteries Safely). Any electrical equipment used in the immediate vicinity of a battery on charge is ATEX Zone 1 rated and includes:

20.1. Torches (5A/2596285 for confirmation and adjustment of electrolyte levels)

20.2. Multimeter Set Fluke, Model 87-5 EX/MOD (used for individual cell voltage and main terminal voltage checks).

BUILDING REQUIREMENTS

General

21. Rooms within a Battery Maintenance Section/Flight that are used for charging batteries are designated BCRs.

22. The BCR is to be well-lit (a minimum of 250 lux in entrances, 350 lux in working areas and offices) cool and have ample ventilation to extract the gases given off by batteries during maintenance operations. For quick guidance, and for installations where the total charging current and number of cells are unknown, a minimum of four air changes per hour for both lead acid and alkaline batteries can be used as the design criterion. Ideally, separate areas should be provided for lead-acid and alkaline battery maintenance.

23. Where only one room is available, to avoid contamination, the two types of battery and associated equipment are to be separated by a minimum distance of 1 metre. Mains electrical fittings should have an acid-proof finish and the recommended lighting is totally enclosed vapour proof luminaires. Where ever possible switch panels are to be located outside the BCR charging area.

24. The floor is to be of non-slip material impervious to attack from acid and alkali. Care should be taken when choosing the flooring, as some materials are also impervious to cleaning chemicals. Floor drainage is not permitted in the charging area where contaminated electrolyte may enter the drainage system. Running water, sinks and draining boards are to be provided for washing equipment. Disposal of contaminated water is detailed in para 21 of this chapter. Any exposed wood on benches is to be constructed of hardwood.

25. Provision should be made for an emergency drench shower. A hot water supply for personnel cleaning is also required.

26. All external doors are to open outwards and all doorways are to be flush fitting with the floor. Steps and thresholds are not to be provided. Existing steps are to be replaced with inclines.

27. Chemical storage areas and the Scrap Battery Compound are to be bunded. Any drains in these areas are to be constructed in such a way as they do not allow contaminated liquid to enter other drains or soak away into the surrounding area. A Polyethylene Modular Spill Deck is available. A list of equipment and suppliers is given in Annex A Table 4 to this chapter. These modules can be linked together to tailor a spill containment area for liquids.

Ventilation

28. A mechanical ventilation system is to be installed in accordance with the following requirements:

NOTES

(1) The ventilation arrangement where the charging bench is against a wall is shown in Fig 1.

(2) The ventilation arrangement where the charging bench is an 'island' is shown in Fig 2.

(3) PVC strips could be used as an alternative to the weighted plastic curtain shown in Figs 1 and 2. A list of equipment and suppliers is given in Annex A Table 4 to this chapter.

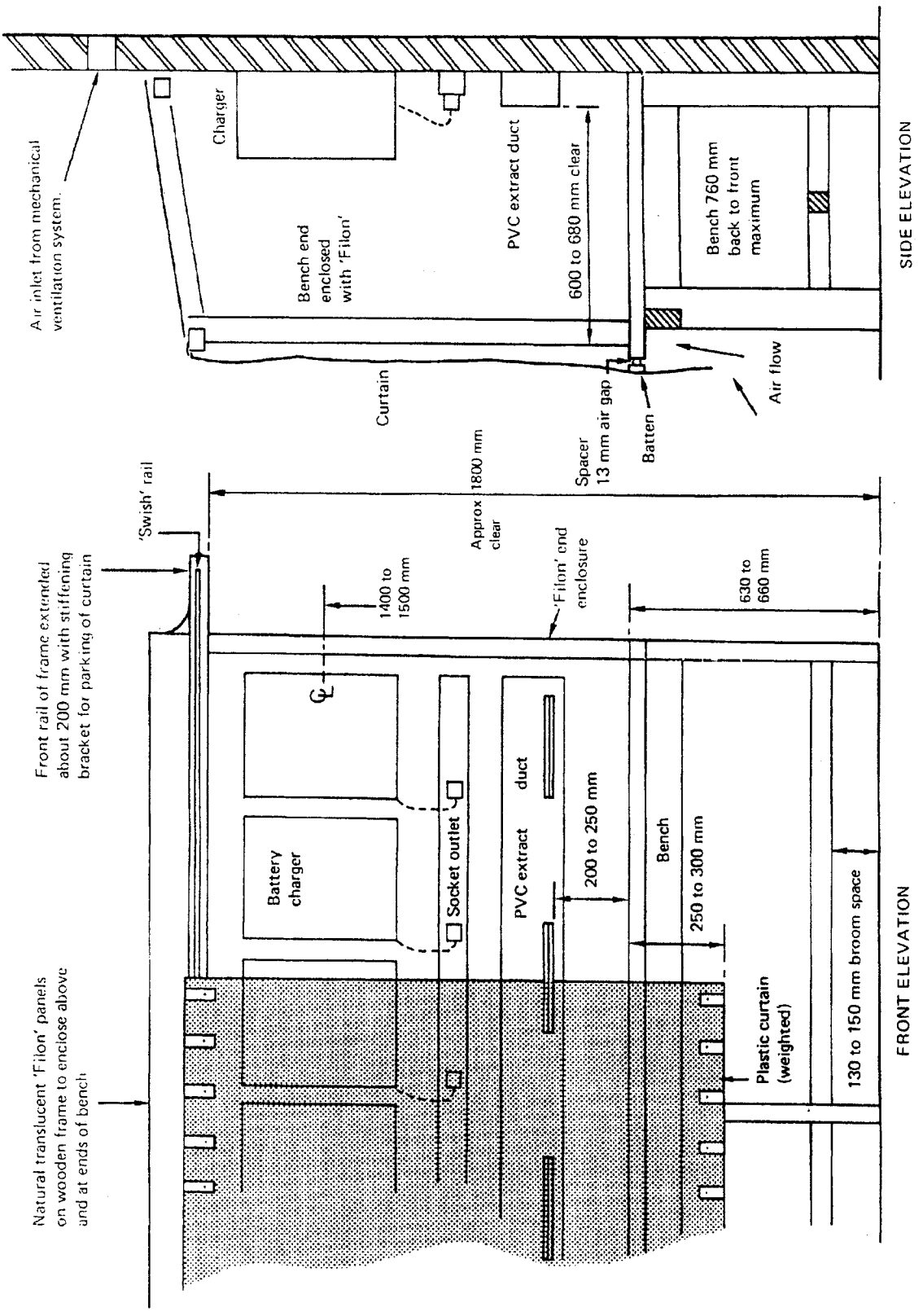


Fig 1 Wall mounted battery charging system with mechanical ventilation

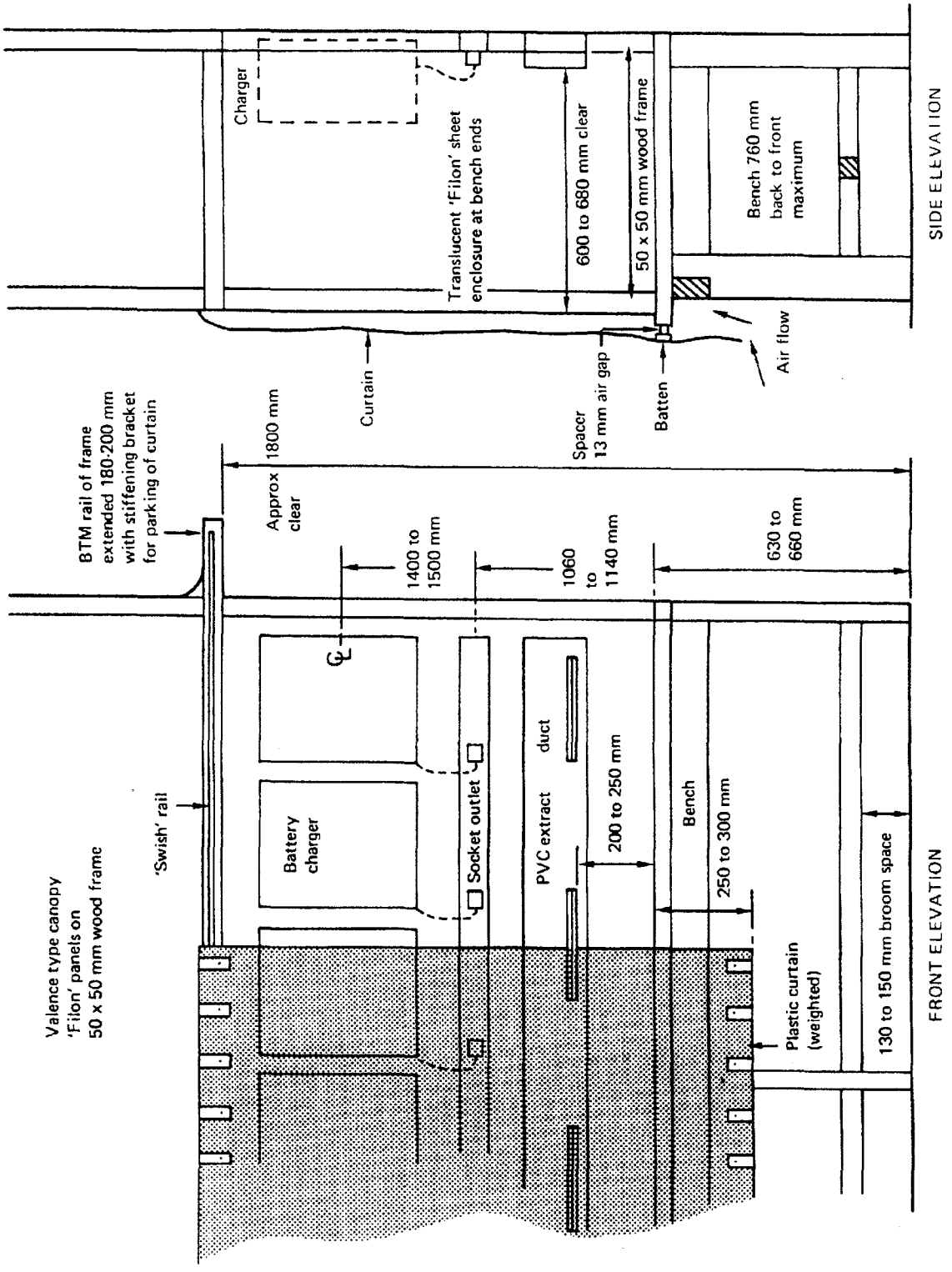


Fig 2 'Island' type battery charging system with mechanical ventilation

28.1. The fans and ductwork are to be of either PVC, PVC coated steel or other approved plastic materials. Any other metalwork for the heating and ventilation (H and V) installation, such as pipes and radiators, are to be protected by an approved plastic coating or by treatment with an acid/alkali resting paint.

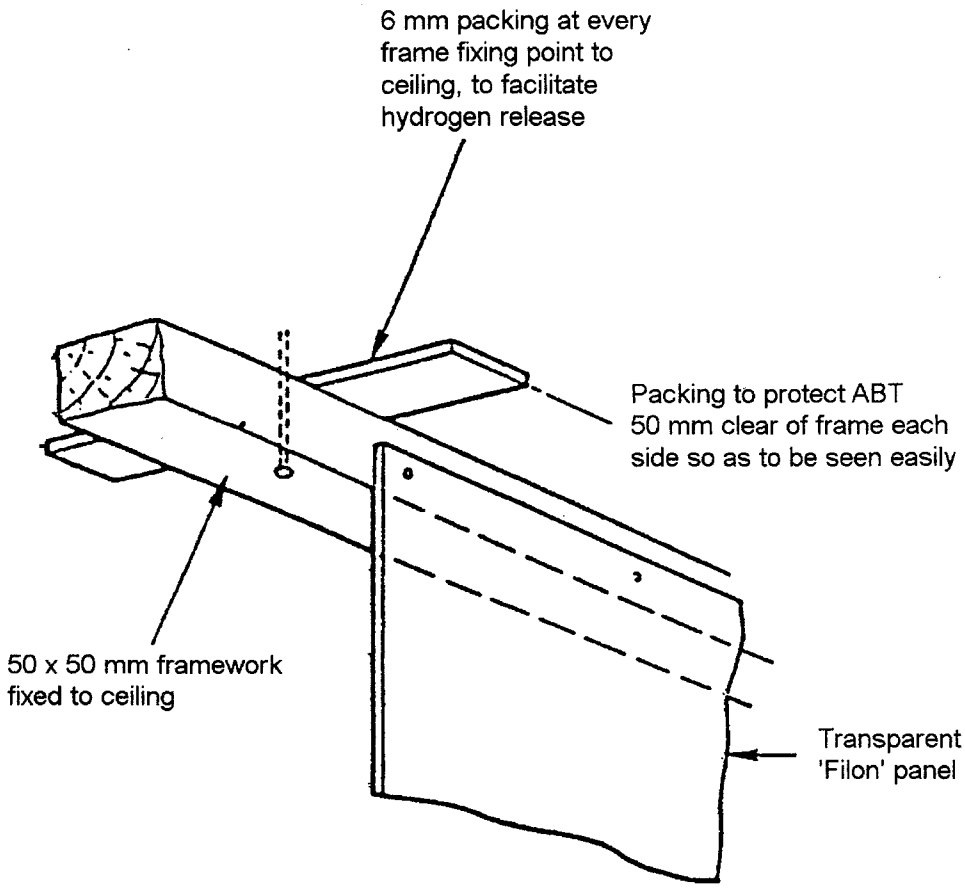


Fig 3 Details of frame fixing to ceiling

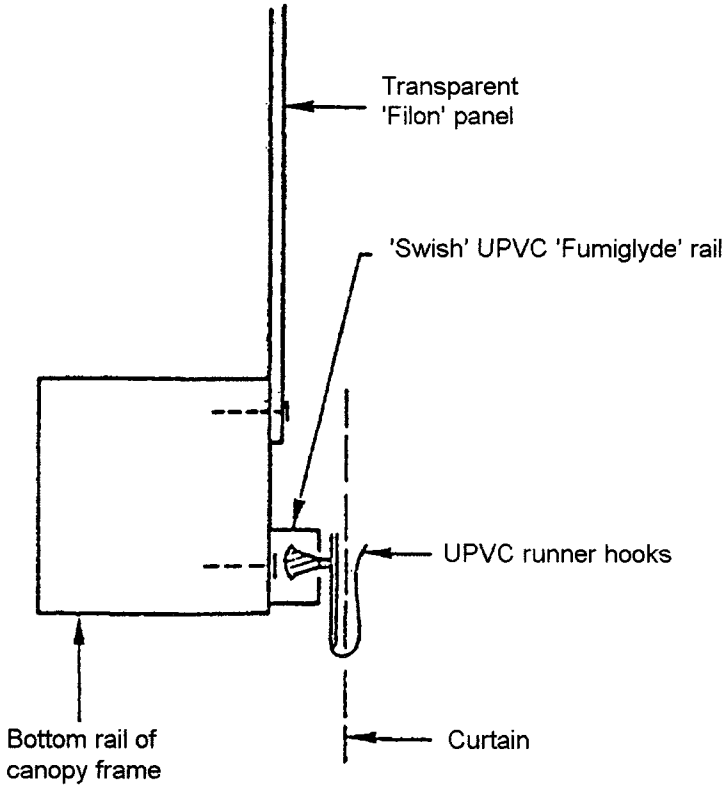


Fig 4 Details of curtain rail (Island type)

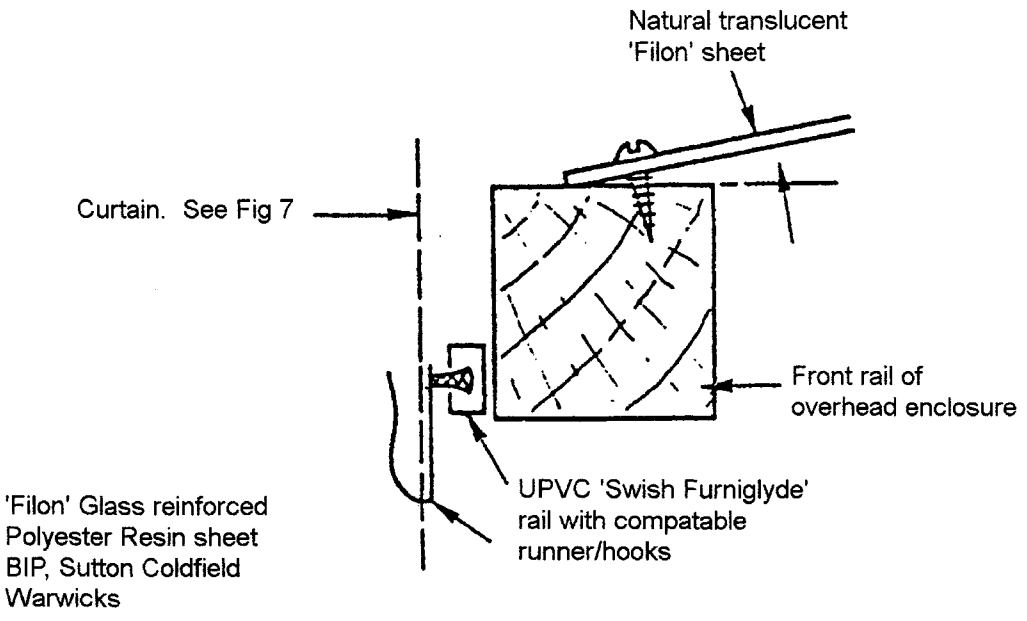


Fig 5 Details of curtain rail (External wall type)

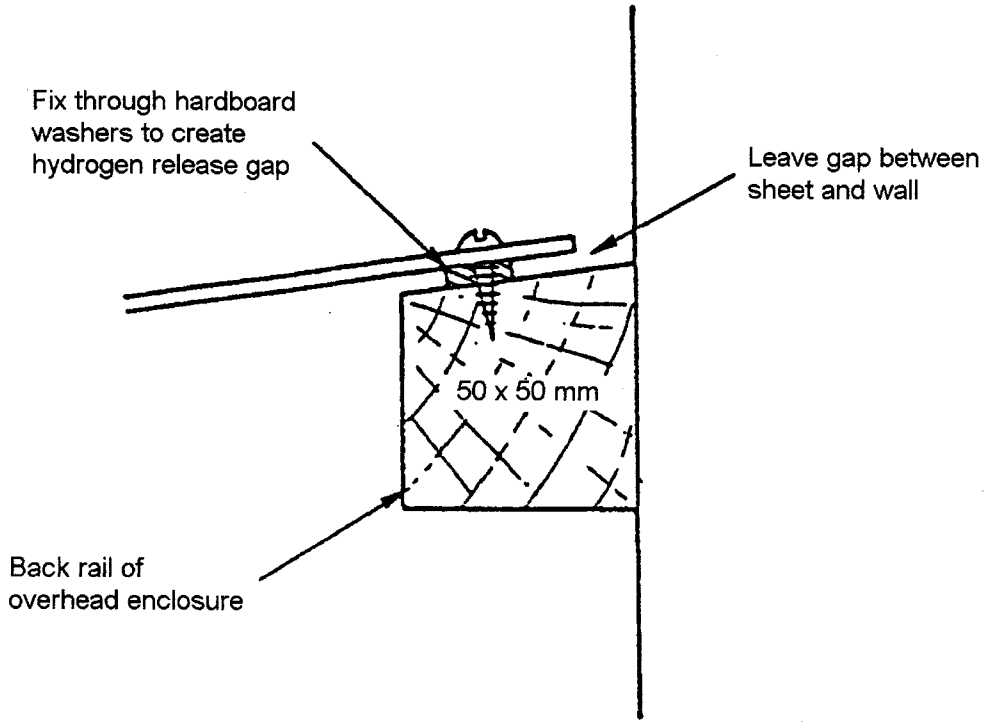


Fig 6 Details of back rail

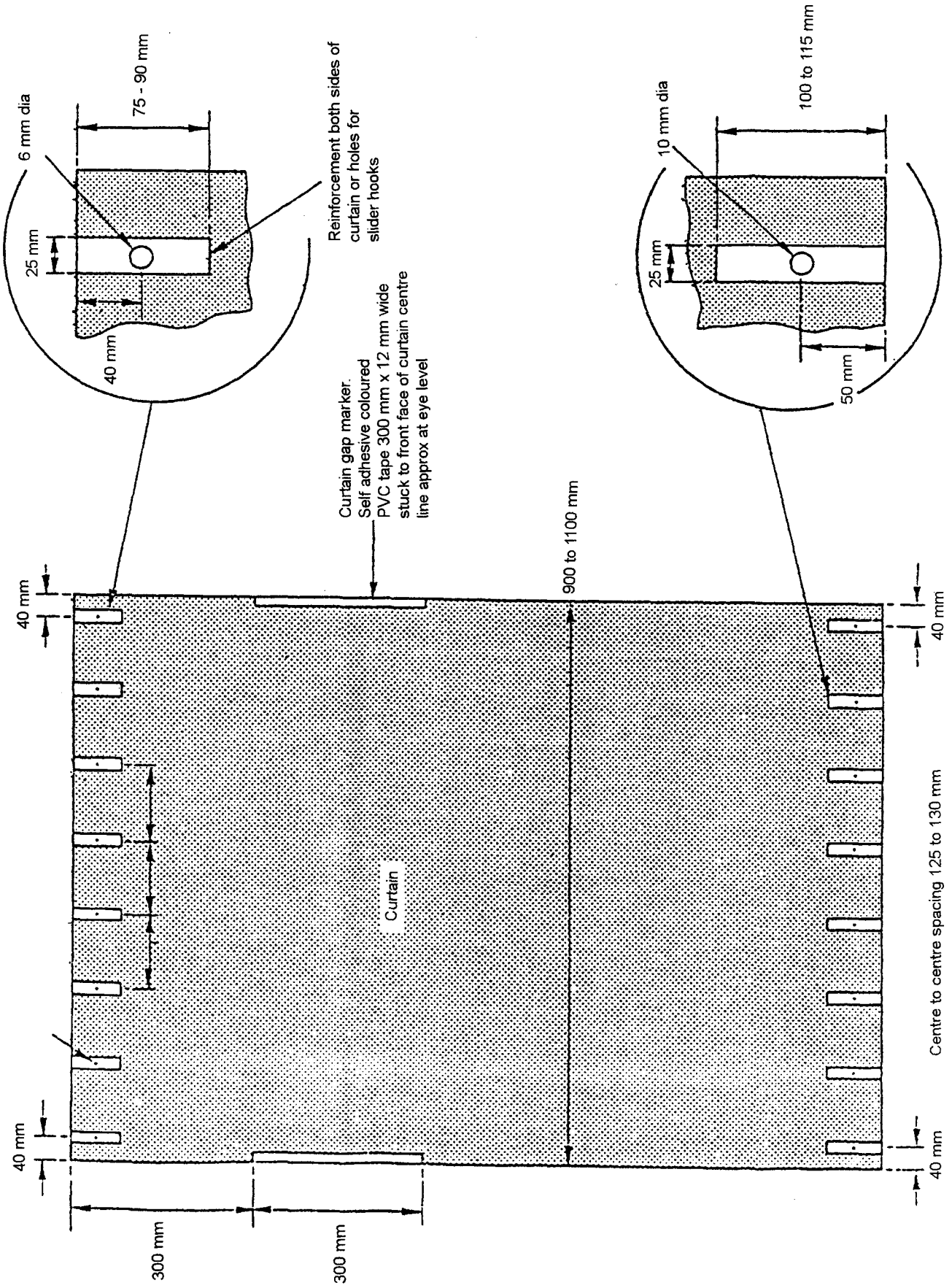


Fig 7 Plastic curtain

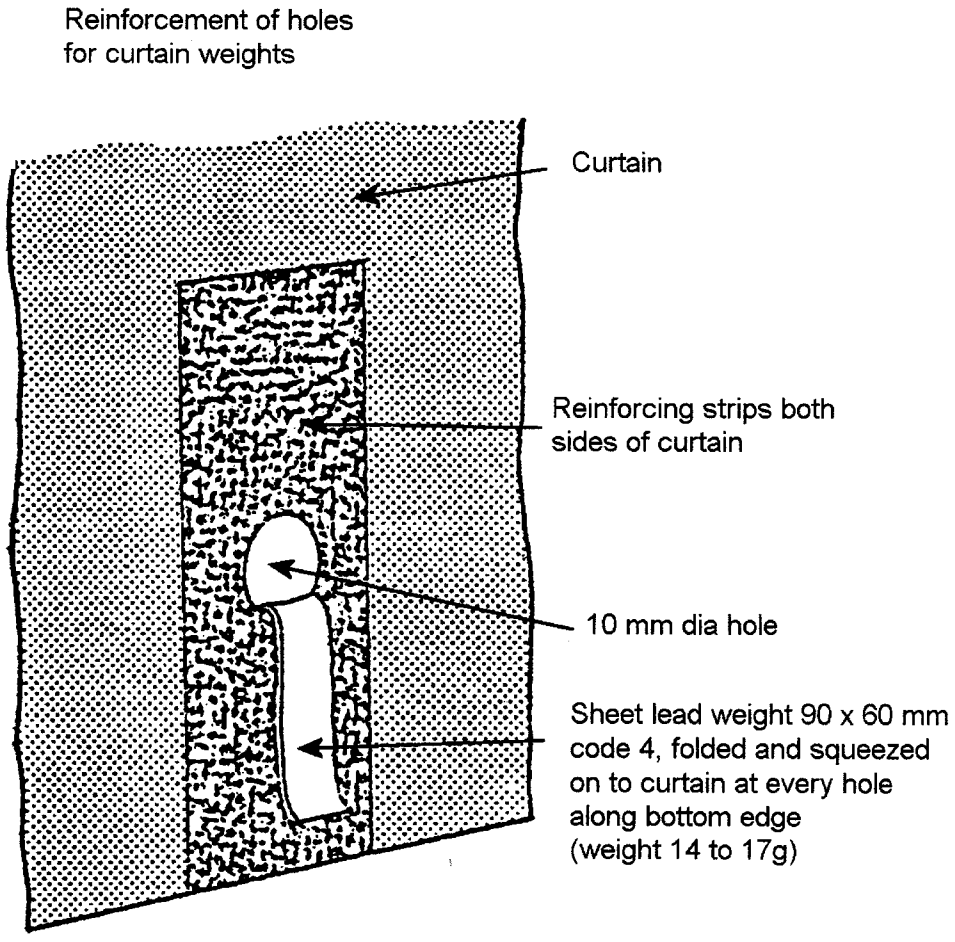


Fig 8 Details of plastic curtain

28.2. Discharge from the extractor duct into the prevailing wind is to be avoided. Outlet vents must be arranged to give adequate dispersal, ensuring that there is no external detrimental effect.

28.3. Inlet ducts to the ventilation systems are to be sited with regard to exhaust fumes given off by aircraft, vehicles or ground support equipment.

28.4. Fans are to be of the bifurcated axial flow or centrifugal type, with the motor situated out of the contaminated air stream. The starting equipment for the fans should be sited externally and interlocked to prevent operation of the charging equipment unless the extraction system is operating.

28.5. Natural ventilation using fixed openings, either at the highest level on an external wall or in the ceiling with equivalent intake openings at low level, is recommended, providing all the following conditions are satisfied:

28.5.1. The batteries are being used as a source of standby power.

28.5.2. The batteries are being trickle charged.

28.5.3. The numbers of batteries do not exceed four.

28.5.4. The batteries occupy less than 15% of the room area.

Temperature

29. The temperature of BCRs should, where possible, be maintained (in accordance with The Workplace Health, Safety and Welfare Regulations 1992) at approximately 16°C. This is the recommended minimum temperature when the BCR is occupied. The maximum permitted electrolyte temperature during charging is 43°C for lead-acid and 49°C for alkaline batteries. However, some batteries of special design have lower limits; the temperature limitations being specified in the associated publication. Environmental temperatures that exceed 27°C for lead-acid and 21°C for alkaline batteries impose time penalties in reaching the fully charged state.

Siting of power supplies

30. External charging facilities are to be provided for the charging of Trolley Battery Electrical Starting and other items of battery powered GSE.

Charging benches

31. The recommended height for charging benches is 630-660 mm. At this height lifting strain on the operator is minimised and an effective visual inspection of the batteries can be made. Bench design is to include acid and alkaline resistant surfaces with ease of cleaning.

31.1. Batteries are not to be allowed to stand directly on wooden or concrete benches, but are to rest on suitable PVC grids. A non-metallic counter top catchment tray could be used. A list of equipment and suppliers is given in Annex A Table 4 to this chapter. These catchment trays have built-in spouts for easy sump drainage and are made from chemical resistant polyethylene.

Storage and issue benches

32. Storage benches are to be provided in sufficient quantity to allow the segregation of lead-acid and alkaline batteries into those requiring commissioning maintenance and those awaiting routine maintenance. The recommended height for storage benches is 630-660 mm. Issue benches are to be further separated into serviceable aircraft and serviceable ground use batteries (GUBs).

Battery Chargers

33. Battery Chargers are to be mounted directly above benches to avoid long connecting leads. An adequate number of mains sockets are to be provided. These are to be as near to the battery charger as possible. All connecting leads from the charger to the battery are to be made of unisheath cable (5E 6425100) and fitted to the correct terminations. Crocodile clips are <u>never</u> to be used.

NOTE

When charging general-purpose lead-acid batteries, connections to batteries with post terminals should be made by connectors Domestic Management Code (DMC) 5J/5940-99-4335310 and 5J/5940-99-4335311. Batteries with lug type terminals are to be connected using a suitable ring tongue, and positively secured by a nut and bolt. If charging aircraft type batteries, connection to the battery is to be by use of the appropriate connector in accordance with AP 113C-0001-1.

BCRs in HM ships

34. Battery charging rooms in HM ships are to comply with the appropriate Defence Standards for Battery Charging Rooms.

SITING OF IN-SITU CHARGING AREAS

35. Areas, other than BCRs used for charging battery powered Ground Support Equipment (GSE) and Mechanical Handling Equipment (MHE), are designated as in-situ charging areas. These areas are to be sited to comply with AP 3409, Chapter 502 and approved by the unit Fire Officer. The charging area is to be clearly defined by RED lines. An area 3 metres beyond the charging area is to be kept clear of all material when battery charging is in progress. This area is to be clearly defined by WHITE or YELLOW lines. When restriction of space does not allow a charging area as previously defined, then fire-resisting screens, at least 2.5 metres high, are to be provided for the charging area. The area within 1 metre of the screen is to be kept clear of all other material when battery charging is in progress. This area is to be clearly defined by WHITE or YELLOW lines. This instruction does not apply to nickel cadmium (Nicad) rechargeable cells. These may be charged using authorised equipment in any supervised area. Nicad rechargeable cells have an equivalent size to popular dry cell sizes, for example, PP9, PP3, AAA (HP16), AA (HP7), C (HP 11) and D (HP 2).

BATTERY POWERED EQUIPMENT

36. Battery powered equipment is to be placed on charge by suitably trained personnel authorised by the Senior Engineering Officer. Authorised personnel are to ensure that:

36.1. The batteries that require charging and are topped up to the correct level with de-ionised water.

36.2. The connections between the charger and the equipment or when the charger is built in, between the equipment and the mains socket, are correctly made.

36.3. When fitted, the charging timer is correctly set.

PROHIBITION OF IN-SITU CHARGING AREAS

37. The in-situ charging of batteries is prohibited in the following areas:

37.1. In hangars containing aircraft using or containing, AVGAS fuel.

37.2. In hangars or any area, where paint spraying is taking place.

37.3. In any area containing Class A or Class B flammable stores.

37.4. In ALL explosive storage areas.

SAFETY SIGNS AND POSTERS

38. The mandatory signs and posters to be displayed in BCRs and in-situ charging areas are listed in Table 1. These posters, apart from Poster 174, can be ordered through The Unit Health and Safety Officer. Poster 174 can be ordered through unit SPFS. In addition to these signs and

posters, a variety of other signs and posters are available from various sources through the Unit Health and Safety Officer. These are listed in Table 2.

TABLE 1 LIST OF MANDATORY SIGNS AND POSTERS

Number	Title	Size
P 11 Code B	Smoking and naked flames prohibited	228 x 330 mm
M 09 Code B	Eye protection must be worn	228 x 330 mm
M 02 Code A	Protective clothing must be worn	457 x 330 mm
M 03 Code B	Hand protection must be worn in this area	228 x 330 mm
Poster 174	Chemical Burns	A3

NOTE

The posters in Table 1 (except poster 174) are available in rigid plastic or self-adhesive vinyl and can be ordered in different sizes. Poster 174 is available either in electronic form or hard copy version from ACGSE4b2.

TABLE 2 LIST OF RECOMMENDED SIGNS AND POSTERS

Number	Title	Size
ISP/M104-1	Handle Acids Safely	762 x 508 mm
ISP/V8-1	Use Only Correct Containers	762 x 508 mm
ISP/033-1	Battery Charging Can be Dangerous	762 x 508 mm
ISP/M80-1	Be Wise Protect Your Eyes	762 x 508 mm

STORAGE OF ELECTROLYTE

39. Separate, bunded, storage and mixing facilities are to be provided for acid and alkaline electrolyte. Containers are to be kept sealed when not in use. Only glass or glazed pottery vessels are to be used for the purpose of mixing electrolyte.

STORAGE AND DISPOSAL OF WASTE ELECTROLYTE AND SCRAPPED BATTERIES

40. A bunded, caged area is to be available to secure containers of waste electrolyte and scrapped lead-acid and alkaline batteries. Waste electrolyte containers are to be clearly marked to identify their contents. Unit supply squadrons are to raise local contracts for the disposal of waste electrolyte and scrapped batteries in accordance with JSP 886. Where the local contract does not allow for the disposal of filled batteries, the batteries are to be fully discharged and emptied of electrolyte prior to disposal. Water that has been used for cleaning BCRs and equipment is to be put into clearly marked containers and stored in the caged area until disposal by the unit supply squadron in the same manner as waste electrolyte. A suggested design of disposal stand and drainage to a container in lieu of an acid pit for use in existing BCRs is shown in Fig 3.

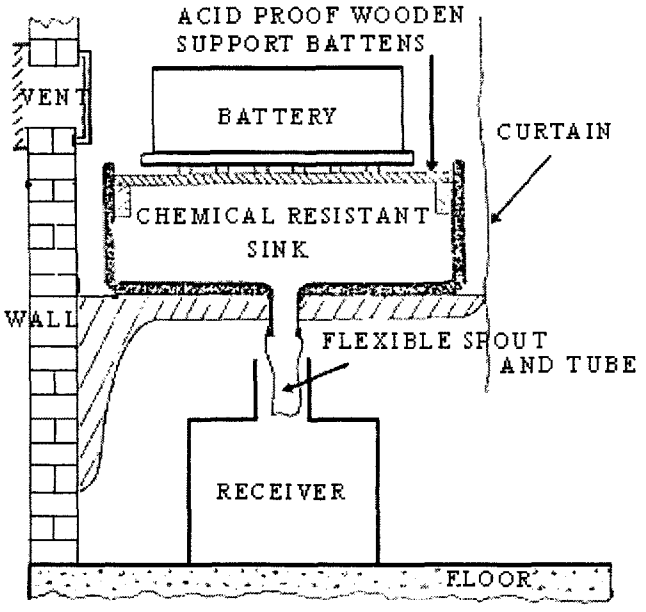


Fig 9 Suggested layout of waste acid collection unit

TOOLS AND EQUIPMENT

Introduction

41. The following describes some of the tools, maintenance and test equipment which may be found in a BCR. Where items are contained within existing publications, a brief description and reference to that publication is given. A list of tools, equipment and materials is given in Annex A Table 4 to this chapter.

Battery chargers (RAF)

42. There are 4 main types of battery charger in use in the RAF. These are:

42.1. The Christie Type RF80-K Battery Charger. (Description in AP 120C-0113-1)

42.2. The Castlet Type 9 Battery Charger. (Description in AP 120C-0114-1)

42.3. The RD Series Battery Chargers. (Description in AP 120C-0109-1)

42.4. The Tecnoservice Digital Battery Charger BCD49-4S-EFA (for Typhoon MOBs and the Deployable Battery Charging Unit (Mobile BCR) only).

Battery chargers (RN)

43. There are several types of battery charger in use in the RN. These are listed in Table 3.

TABLE 3 BATTERY CHARGERS USED IN THE ROYAL NAVY

TYPE	CLASS OF VESSEL	TOTAL	NSN	MANUFACTURER	BR	SERVICE
Automatic Constant Current	TYPE 42		6130-99-530-3956	Foster Transformers	4500 (804)	NiCad Batteries up to 22Ah
6773	MCMV		6130-99-544-4003	Westinghouse		
PAP (6736)	SANDOWN		6130-99-534-9454	Westinghouse	4500 (806)	RCMDS
1RS 250A	HMS OCEAN		6130-99-517-3849	Gresham Power	7884 (812)2	
1RP 250A			6130-99-362-8067	Gresham Power		
Type F (RP 900A)	LPD, T42		6130-99-534-2713	Gresham Power	4500 (808)	Aircraft/ General
Type A	SURFACE FLEET /AOR		6130-99-461-3393	Signature Industries Ltd	4500 (803)	Charging Sea-Rider service battery
Type B	CVS, T22, T42		6130-99-461-3391	Signature Industries Ltd	4500 (807)	Emergency Lighting Units
Type H	CVS	2	6130-99-538-8837	C&N Electrical		
Type 2	T23		6130-99-051-0048	Enersys Inc		
Type 6	T23 (MONTROSE ONWARDS)	9	6130-99-142-8694	Castlet Ltd		Portable battery Charger
Type 10	T23		6130-99-742-7670	Enersys Inc		
NP100/P	LPD		6130-99-641-9797	Enersys Inc		
TS2X020	LPD		6130-99-641-9386	CASC		
TS 1340	ALL SUB AND SURFACE FLEET		6130-99-257-8644	CASC	4500 (810)/ 7884 (812)1	Universal
TS 1340+	SURFACE FLEET		6130-99-391-3441	CASC		Universal
656215	LPD(R)	10	6130-99-641-9797	OLDHAM COMPTON		
AXESS IC60	LPD(R)	10	6130-99-729-9425	OLDHAM COMPTON		
3CP 220/110				ERSKINE	BR7801(7)A	
CP				ERSKINE	BR 7209	
CP 24/35 & BE 24/25				ERSKINE	BR 7801(7)B	
CP 24/50				ERSKINE	BR 7803(4)	
2230A-C				MARCONI MARINE	TP 1105	
2357A				MARCONI MARINE	TP 1107	
ZOO-7516-01				MARCONI MARINE	BR7800(4)B	
ZOO-7517-01 TO 4	MOORING AND SALVAGE VESSELS			MARCONI MARINE	BR 7825(70)	
8931			6130-99-919-6314	EMS Manufacturing		
Battery Charging Panel	TYPE 22		6130-99-538-1698	VT Ship Builders	4500 (809)	Machinery control batteries
Type H	CARRIERS		6130-99-538-8837	STS Defence, Gosport		
CC3010C	ARK ROYAL		6130-99-902-0769	Varta		
C&C	HUNT	11	6130-99-538-6589	AISH TECHNOLOGY		
1619A	LANDING CRAFT		6130-99-721-4149	Aries Powerplant		
Constant Voltage for Lead Acid			6130-99-495-9474	RS Components		
			6130-99-461-3217			
MC1004			6130-99-700-5948	Deltec Power		
ELS371C			6130-99-530-0999	John Drummond		
24/100	LANDING CRAFT		6130-17-114-6897	Skylla		
6102	MARCHWOOD		6130-99-545-5220	FC Heayberd		
CONSTAVOLT A5/A22 ,A40/A41			6130-99-461-3217	G&M	TP 983	
MC1004			6130-99-700-5948	Deltec Power		
ELS371C			6130-99-530-0999	John Drummond		
24/100	LANDING CRAFT		6130-17-114-6897	Skylla		
6102	MARCHWOOD		6130-99-545-5220	FC Heayberd		
CONSTAVOLT A5/A22 ,A40/A41				G&M	TP 983	
LOADFLOAT				NORTON DEVICES	BR 7812(4)A	
	23m TENDER				BR 7817(9)	
	RAMPED CRAFT 03-05 ARMY				BR 7824(7)	

TABLE 3 BATTERY CHARGERS USED IN THE ROYAL NAVY CONT'D

TYPE	CLASS OF VESSEL	TOTAL	NSN	MANUFACTURER	BR	SERVICE
CVT 12/3	RESCUE BOAT				BR 7829(17)	
ABC 24/15P	FAST MOTOR LAUNCH				BR 7829(18)	
ECP					BR 7829(22)	
MODEL 30T					BR 7830(77)	
24V					BR 7843(4)	
110V					BR 7843(5)	
MODEL 307					BR 7845(11)	
	RAMPED CLASS 06-09				BR 7869 (7)	

43.1. Fosters battery charger. The Fosters charging board is an obsolescent, fixed, shipborne, two step, constant current charging board which is being replaced by the Type 'F' constant current charging board. Details of the Fosters battery charger can be found in BR 4500 (804).

43.2. G and R Type 'F' battery charger. The G and R type 'F' battery charger is a fixed ship borne, three step constant current charging board with an output of 0.5 to 25A d.c. Details of the G and R type 'F' battery charger can be found in BR 4500 (808)

43.3. Type 6 battery charger. The type 6 battery charger is a free standing, constant current charging board with an output of 0 to 30A. Details of the type 6 battery charger can be found in AP 120C-0106-1.

43.4. Battery charger panel Type A. The battery charger panel type A is designed to step down the mains a.c supply and provide a full wave rectified d.c. output for charging motor boat batteries at a normal full load current of 13A. Details of the battery charger type A can be found in BR 4500 (803).

43.5. Battery charging cabinet Type H. The battery charging cabinet type H is a forced ventilation charging cabinet capable of accommodating and simultaneously charging lead-acid or nickel cadmium batteries. For details of the battery charging cabinet type H, refer to specifications DGS/DNEE/V1/2249 and PIL C16/50.

Capacity test sets

44. Capacity test sets are used to determine the capacity of a battery in terms of percentage and are principally used on aircraft batteries. The types of capacity test set presently in use are listed in Annex A Table 2 of this chapter. AP 120C-0203-1 is the Air Publication for the Battery Capacity Tester (RE Type 3 - RN)(6625-99-1940630); the Battery Capacity Tester Type 2 (6130-99-6134575) is described in detail in paras 26 to 31.

NOTE

A manufacturer's handbook will be issued by DS&TE TEMO with each Battery Capacity Tester Type 2 in lieu of an Air Publication.

BATTERY CAPACITY TESTER TYPE 2

45. The Type 2 Battery Capacity Tester is designed to test all aerospace and ground use batteries in military use and is a direct replacement for the obsolete or obsolescent Battery Capacity Testers listed in Table 4.

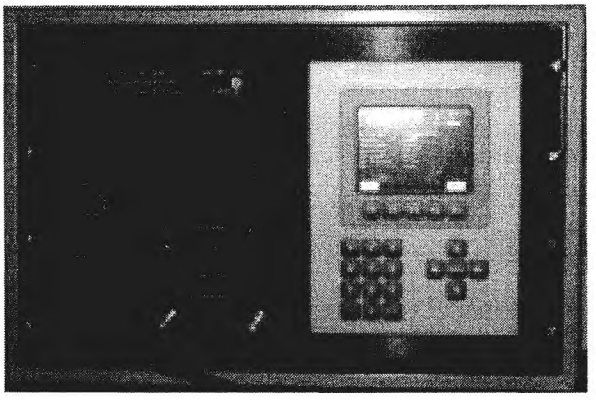


Fig 10 Battery Capacity Tester Type 2

TABLE 4 LIST OF OBSOLETE CAPACITY TESTERS REPLACED BY TYPE '2' CAPACITY TESTER

Ref No	Item
Z4/6625-99-1949222	Battery capacity tester (ARMY)
6625-99-1940630	Battery capacity tester (RE Type 3) (RN)
6625-99-4096247	Battery capacity tester (RE 4000C) (RN)
5G/6625-99-4160254	Battery capacity tester (RE 4000C)

46. The fit, form and function of the Battery Capacity Tester Type 2 differs in design from the testers it has replaced, taking advantage of recent technical developments in electronic engineering and digital instrumentation. The Battery Capacity Tester Type 2 is designed to test to a higher capacity for standard discharging processes and has introduced the capability to test at a high discharge rate for a short period.

47. New testing parameters are designed to account for all aerospace and ground use batteries in military use with consideration afforded to batteries that may be introduced into service in the future.

LEADING PARTICULARS - BATTERY CAPACITY TESTER TYPE 2

Manufacturer's Part No MR11600

Dimensions:

Height (Overall) ..... 365 mm

Depth (Overall) ..... 360 mm

Width (Overall) ..... 517 mm

Weight ..... 37 kg

Operating Parameters:

Operating Voltage ..... 90 to 260 V ac

Operating Frequency ..... 47 to 63 Hz

Testing Parameters
Suitable for discharging Lead Acid and Ni-Cd batteries of:

Battery Voltage (max) 40Vdc

Battery Voltage (min) 0.9Vdc

Discharge Current (max) ..... 65Amps dc

In addition, the Battery Capacity Tester has a high discharge capability for a short term of 10 minutes maximum:

Battery Voltage (max) 28Vdc

Battery Voltage (max) 19Vdc

Discharge Current (max) ..... 150Amps dc

48. In manual mode, the operator selects the Battery Capacity, Trip Voltage and Test Duration. The tester will perform the test at the ampere hour rate (capacity) of the battery. If however, a different time is chosen, the tester will automatically re-calculate the required discharge current in order to complete the test in the specified time. During the test, the accumulated capacity of the battery will be displayed correctly in both Ah and percentage efficiency. An alarm will sound when the test is completed or if the test fails. Once the test is either completed or failed, the data is displayed until reset by the operator. This enables the reading of battery voltage at end of test and its measured capacity.

49. During discharge testing, the Battery Capacity Tester employs an active load with local feedback compensation to 'sink' electronically the required current from the battery under test. To increase the capacity for higher discharge testing, power resistors are introduced in parallel to dissipate the additional power.

50. For a more automated operation, the new Battery Capacity Tester has digitised instrumentation including a keypad interface with battery testing programme functionality. This enables the operator to input the testing parameters of particular batteries, which may be saved and used by quick and simple keypad selection. Programme selection is identified by the NATO Stock Number (NSN) of the battery under test.

Heavy discharge cell tester

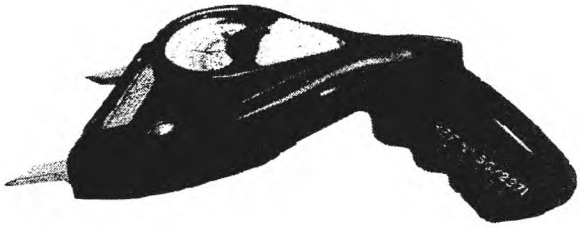


Fig 11 Heavy discharge cell tester

51. The heavy discharge cell tester 5G/6625-99-4411732 consists of two probes, across which is connected a calibrated heavy-duty resistor and a centre zero voltmeter. The scale of the voltmeter has coloured sectors to indicate whether the cell on test is serviceable or unfit for use.

NOTE

The heavy discharge cell tester is not to be used within a BCR or on freshly charged batteries that may still be gassing.

Digital Battery Analyser Type 475

Fig 12 Digital Battery Analyser Type 475

52. The digital battery analyser (6130-01-4626840) is a 6/12 volt battery testing system for use in BCRs or on vehicles. It will give an accurate indication of the state of charge of a battery without discharging the battery.

NOTE

The DBA is only to be used to test 6 or 12 volt batteries – use on 24 batteries will render the DBA unserviceable.

Operating Instructions

53. Clean battery posts or side terminals with a non-conducting brush.

NOTE

For group 31 or side-post batteries, install & tighten lead terminal stud adapters (included). Failure to install stud adapters, or using stud adapters that are dirty or worn may result in false test results.

Connecting the Tester

54. Connect red clamp to positive terminal.

55. Connect black clamp to negative terminal.

NOTE

To ensure a proper connection, rock the clamps back and forth. The tester requires both sides of the clamp to be firmly connected prior to testing. A poor connection will prevent testing & a ***CHECK CONNECTION*** message will appear. If this occurs, clean the terminals & reconnect.

Prior to testing

56. Use the **yellow** arrows to scroll to the CCA (Cold Cranking Amp) rating of the battery.

57. Press the **green** start button to test.

58. After testing, if the battery's temperature is 32°F / 0°C or below, press the **blue** temperature compensation button to get a compensated test result.

If display does not illuminate:

59. Check connection to the battery.

60. Battery may be too low to power the tester (below 5.5 volts). Fully charge the battery and retest.

NOTES

(1) If testing in the vehicle, make sure all vehicle accessory loads are off & the ignition is in the 'off' position. Read **Testing In A Vehicle** section before testing.

(2) If the tester displays SYSTEM NOISE message when the battery is not connected to the vehicle, the test may be being conducted too close to a source of noise (charger or other high-current device). If so, move away & retest. If no source is identified, fully charge the battery and retest. If message appears after charging, replace the battery.

Testing in a Vehicle

61. Turn on the high beam headlights for one minute to remove the battery's surface charge, then wait at least one minute to allow the voltage to recover before starting the test.

61.1. A ***REPLACE*** reading may be the result of a poor connection or corrosion between the vehicle's battery cables and the battery. Retest the battery after disconnecting the cables before replacing.

NOTES

(1) If the SYSTEM NOISE message appears, make sure all vehicle accessory loads are off & the ignition switch is in the 'off" position. Retest.

(2) If the SYSTEM NOISE message continues after several retest attempts, disconnect the battery cables & retest.

Test Results

62. Use the following indications to identify the level of charge of the battery and any corrective maintenance that should be carried out.

- GOOD BATTERY= Fully charged. Return to service.
- GOOD-RECHARGE = Charge battery & return to service.
- PULSE CHG / RETEST = Pulse charge battery (Pulse chargers not used in MoD)
- REPLACE BATTERY= Replace battery.
- BAD CELL-REPLACE= Replace battery.

ACFIL pump battery filler

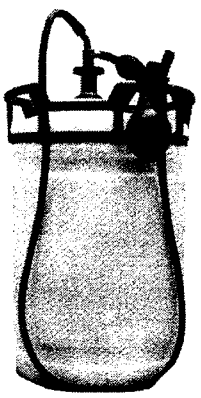


Fig 13 ACFIL pump battery filler

General

63. The Acfil pump type battery filler (4320-99-9006318) is used to pump diluted sulphuric acid or de-ionised water. The pump consists of a spherical rubber expander, a body with

connections for pipes and a knurled nut and bell-mouthed sleeve for expanding the expander to make an airtight fit in the neck of the containers. A bulb type bellows, fitted with two one-way valves, is used for pressurising the inside of the container. A short pipe fits on the tube at the base of the bung and is suspended in the container. A lead weighted sinker, attached to the pipe, ensures that the pipe sinks to the bottom of the container. A further pipe is fitted with a pinchcock at the open end for controlling the delivery of the liquid. Two different sizes of nozzles are supplied with the pump to suit the varying sizes of battery vent holes. The nozzles are a push fit in the open end of the long pipe.

NOTE

The pipes normally supplied with the pump are made of rubber and are suitable for use with diluted sulphuric acid only. For use with concentrated acid, special plastic pipes are to be used and the outlet pipe is to be secured to the pump body by a hose clip.

Method of operation

64. The Acfil pump battery filler is operated as follows:

64.1. Assemble the pump in accordance with the manufacturer's instructions.

64.2. Fit the expander in the neck of the container and tighten the knurled nut.

64.3. Insert the nozzle inside the battery or container that is being replenished.

64.4. Pressurise the container by pressing the sides of the bellows a few times until a slight pressure can be felt in the bulbous portion of the bellows tube. To avoid interference with the operation of the valve, ensure the sides of the bellows are pressed and not the end.

64.5. When pressure is felt in the bulbous portion of the bellows tube, press the pinchcock and liquid will flow from the filler nozzle. When a flow has been achieved, operate the bellows only sufficiently to maintain the flow.

64.6. To stop the flow, allow the pinchcock to nip the pipe.

64.7. After use, release the air pressure by removing the bellows from the pump body.

NOTE

The container is not to be left in a pressurised condition after use.

Maintenance

65. If the Acfil pump fails to operate satisfactorily, check the pipes for leaks, that the knurled nut is tight and the bellow is not punctured. Ensure that the passage through the pump body and nozzle is free from obstruction. If the bellows are not faulty and no punctures are evident, the trouble may be traced to faults in the two valves inside the bellows. These may be sticking, and an attempt is to be made to free them by operating the bellows a few times.

Hydrometer Type B

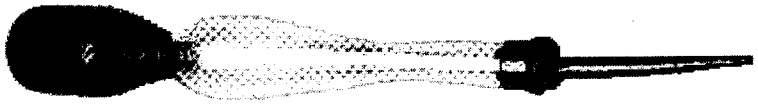


Fig 14 Hydrometer type B

General

66. The hydrometer, Type B (5J/6630-99-9575058, AP 120C-0205-1), is used for measuring the specific gravity of the electrolyte in lead-acid batteries. The hydrometer consists of four parts, a glass body, float, nozzle and a rubber bulb. The float is graduated to read specific gravities between 1.00 and 1.400; the scale is marked with a red line at 1.270.

Operation

67. Insert the nozzle of the hydrometer beneath the level of the electrolyte and draw the electrolyte into the body of the hydrometer by pressing and releasing the rubber bulb. If this is the first usage of the day, repeat this procedure at least twice, in order to 'wet' the glass interior and allow an accurate reading to be taken. Care is to be taken to draw in sufficient liquid to ensure that the hydrometer float is floating freely, but does not rise high enough to bring the upper part of the float in contact with the rubber stop. The specific gravity of the liquid may then be read off directly from the hydrometer scale.

Battery leakage tester

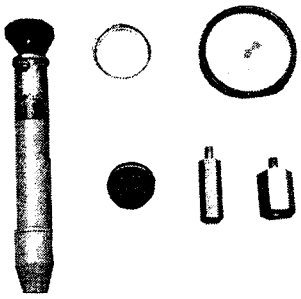


Fig 15 Battery leakage tester

General

68. The battery leakage tester (5J/6140-99-4335341, AP 120C-0207-1) is used to detect leaks and cracks in the casings of lead-acid batteries. The tester consists of a combined hand pump and pressure gauge and is operated by placing it directly onto the vent hole of the battery casing under test. Pressure, which is developed by a hand pump fitted with a non-return valve, passes to a nozzle adapter, which is placed over the battery vent hole. The nozzle adapter is fitted with a sealing ring, and light hand pressure effectively prevents any leakage of air pressure at this point.

Operation

69. With the vent stoppers in place on the battery, place the battery leak tester, with adapter fitted, in a vertical position over each vent in turn and hold firmly in position. Apply a pressure of 1lbf/in^2 and check that the pressure does not drop by more than 0.05 lbf/in^2 in 15 seconds.

Maintenance

70. Subject to general cleaning and calibration of the gauge, no maintenance is required. The cup washers may be replaced as necessary. Although robust in construction, normal care is to be exercised in the handling of the tester in order to avoid damage to the pressure gauge.

Elgastat B114 de-ioniser

Caution

BATTERY DAMAGE. De-ionised water is not to be produced in quantity and stored, as carbon dioxide (CO^2) absorption from the atmosphere can, over a long period, have an adverse effect on certain batteries. De-mineralised water is not as pure as de-ionised water and is not to be used in batteries.

71. Tap water is passed through a cartridge where purifying resins remove mineral salts such as calcium, iron, magnesium and chloride, which are harmful to batteries. A water test facility is incorporated in the unit that operates from a 9V battery. This will indicate when a cartridge has been exhausted by the meter needle resting in the red zone on the meter scale when the test button is pressed.

Cleaning equipment

72. The cleaning of battery charging room floors and walls is to be carried out using mops and plastic buckets and not by using hosepipes. The disposal of contaminated water is described in Para 21 of this chapter.

SAFETY AND HANDLING PRECAUTIONS

Introduction

73. The following safety precautions exist for the protection of personnel working in a BCR. Every BCR is a potentially dangerous location and the actions of all personnel working in a BCR are to be governed accordingly. Various hazards are present when storing and charging batteries, these are:

73.1. Risk of chemical burns or electric shock to personnel.

73.2. Risk of chemical or physical damage to equipment.

73.3. Risk of fire.

73.4. Risk of back injury.

Electrolyte contamination, spillage and neutralising agents

74. Electrolyte contamination of benches or floors, is to be neutralised in the following manner:

74.1. Acid. Soak up the excess acid using sand that is to be removed before treating the affected area with a saturated solution of Sodium Bicarbonate. The area is then to be washed down using a mop and bucket. The contaminated contents of the bucket are to be disposed of as directed in para 21 of this chapter. The contaminated area is to checked with litmus paper; clean-up operations are to be carried out until the litmus paper indicates no contamination.

74.2. Alkaline. Soak up the excess alkaline using sand, which is to be removed before treating the affected area with a saturated solution of Boric Acid. The area is then to be washed down using a mop and bucket. The contaminated contents of the bucket are to be disposed of as directed in para 21 of this chapter. The contaminated area is to checked with litmus paper; clean-up operations are to be carried out until the litmus paper indicates no contamination.

75. In both cases, the contaminated sand/water is to be stored in an acid alkaline resistant container in the caged area prior to disposal by the supply squadron.

NOTE

Under no circumstance is waste electrolyte or contaminated water to be put down the main drains or soakaways/acid pits.

Fire precautions

76. When considering the fire precautions required in the BCR or Acid Store, reference is to be made to the following:

76.1. Crown Fire Standard F6.

76.2. AP 957.

77. The type, position and quantity of fire extinguishers required for a BCR or Acid Store is to be decided after consultation with the Unit Fire Officer.

First aid eye irrigation

78. A suitable eye irrigator, (for example, Eyewash Station, containing sterile sodium chloride solution, which can be obtained from the Unit Medical Centre) is to be stored close to the place of work. On no account is a partially used bottle to be retained for re-use. In new designs of BCRs, plumbed in eye irrigators should be given consideration. An alternative method of eye irrigation, which is both rapid and effective, is to put the patient's head under a cold tap and allow water to flow over the eyes. The Unit Medical Officer is to be informed immediately of any eye contamination and any serious skin contamination. Eye irrigation is to be continued until medical assistance arrives.

Lifting equipment

WARNING

(1) BATTERIES/CONTAINERS ARE HEAVY AND OFTEN CONTAIN DANGEROUS LIQUID. THEY ARE TO BE HANDLED WITH CAUTION; THE USE OF MANUAL HANDLING EQUIPMENT IS RECOMMENDED.

79. Batteries can be very heavy and may be dangerous to move single-handed. All manual handling activities are to be assessed in accordance with the Manual Handling Operations Regulations 1992. The following equipment may be found in a BCR:

79.1. Sack barrow trolley (4DD/3920-99-4227427).

79.2. Wilmat battery lift (4D/3920-99-9731774).

79.3. Scissor Table (4DD/3920-99-6403829)

Manning of BCRs

80. The manning of BCRs is mandatory whenever battery charging is taking place. The importance of this will be realised when consideration is given to the need to constantly monitor both aircraft and 'Sealed for Life' batteries during the charging phase of their maintenance. Whenever battery charging takes place in a trolley accumulator bay, providing the charging equipment has a 'power on' indicator, the charging area is external to the BCR and the requirements of AP 3409, Chapter 502, are satisfied, then the trolley accumulators may be charged unattended.

Metal watchstraps and jewellery

81. Metal watchstraps and jewellery are not to be worn in a BCR.

Naked lights and spark prevention

82. Highly flammable gases are given off during battery charging, consequently, naked lights, matches and lighters are not to be brought into a BCR. For the same reason, portable electrical equipment and torches are to be of the spark proof type such as the ATEX torch (5A/2596295). Connections are NOT to be made or broken with the battery charger power switched 'ON'. At the end of the charging period, after switching 'OFF', the charging leads are to be disconnected first at the battery and then from the supply terminals. Prior to switching the charging board 'ON' or 'OFF' the output control on the charging board is, where possible, to be turned to the 'ZERO' position.

Personnel contamination

83. Any contamination of personnel or clothing is to be immediately treated by flushing with clean water. Clothing is to be removed as soon as possible to prevent skin contamination. Any contaminated water should be disposed of in accordance with para 21 of this chapter.

Protective clothing and barrier creams

84. A coverall is the minimum item of protective clothing that is to be worn within any work area concerning battery maintenance. When handling batteries or carrying out maintenance tasks a risk assessment should be carried out by the line management to assess the degree of protective clothing required.

85. Table 5 provides a list of protective clothing that may be taken into account when carrying out a risk assessment. A comprehensive list of protective clothing can be found in JSP 437, which is held by the Unit Health and Safety Officer.

TABLE 5 LIST OF PROTECTIVE CLOTHING

Ref No	Item
8430-99-9425933 to 9425945	Boots, knee, rubber
8415-99-9757207 to 9757209	Gloves, rubber, heavyweight (acid and alkaline resistant)
8415-99-8694334 to 8694335	Gloves, rubber (acid and alkaline resistant)
22G/4240-99-1277504	Faceshield, industrial
4240-99-9788783	Headband, face shield, industrial
4240-99-1306655 to 1306658	Full, faceshield, industrial
4240-99-3739730	Goggles, industrial
8415-99-1253405	Apron, (acid resistant)
8415-99-1278270 to 1278272	Trousers, overall, bib and brace (acid and alkaline resistant)
8405-99-1301160 to 1301170	Coverall
8415-99-8696948 to 8696952	Coverall (acid resistant)
8415-99-1306262 to 1306268	Coat, overall

86. When mixing acid or electrolyte, a risk assessment has to be carried out by the line management to assess the amount of protective clothing required to carry out the operation.

NB. A second person must be present during the mixing of any chemicals.

87. Barrier cream is to be used at all times when working in a BCR or Acid Store. Protective clothing is to be checked for contamination before and after use, and washed down with clean water. Any contaminated water should be disposed of in accordance with Para 21 of this chapter. Protective clothing should be stored by hanging it on clothes hooks in a well-ventilated area. They are never to be stored in a folded condition.

Smoking

88. Smoking is not permitted in a BCR. Smoking may be permitted in rooms that are designated under the Unit smoking policy. These rooms must not have direct access to a BCR and the gas produced in the BCR must not able to enter these rooms.

Tools and containers

89. All metal tools long enough to constitute a short-circuiting risk are to have as much of their surface areas as practicable insulated with rubber or similar sleeving. Tools, hydrometers, syringes and containers are to be maintained free from acid or alkaline when not in use. Separate items of such equipment are to be used for the different types of batteries, colour coded to avoid confusion, i.e. RED for lead-acid and BLUE for alkaline. All containers are to be clearly marked

to indicate their contents. Containers for acid are not to be used, placed or stored in an area where alkaline batteries are maintained or vice-versa.

CHAPTER 1 ANNEX A

LIST OF EQUIPMENT, TEST EQUIPMENT AND MATERIALS

CONTENTS

TABLE 1 LIST OF EQUIPMENT

Ref No	Item
5P/6130-99-0206592	Battery charger, Christie Type RF80-K
5P/6130-99-1984021	Battery charger, Castlet Type 9
5P/6130-99-3012565	Battery charger, Type RD110E
6130-99-5342713	Battery charger, G & R, Type F (RN)
6130-99-4613393	Battery charging panel, Type A (RN)
6130-99-1428694	Battery charger Type 6 (RN)
6130-99-5280574	Battery charger Fosters (Cruisers)
6130-99-5303956	Battery charger Fosters (Destroyers)
6130-99-5388837	Battery charging cabinet Type H (RN)
6130-15-2026617	Digital Charger BCD40-4S-EFA
4DD/3920-99-4227427	Trolley, sack barrow
4D/3920-99-9731774	Wilmat battery lift
4DD/3920-99-6403829	Scissor Table
4320-99-9006318	ACFIL pump battery filler

TABLE 2 LIST OF TEST EQUIPMENT

Ref No	Item
Z4/6625-99-1949222 (See Note 1)	Battery capacity tester (ARMY)
6625-99-1940630	Battery capacity tester (RE Type 3) (RN)
6625-99-4096247 (See Note 1)	Battery capacity tester (RE 4000C) (RN)
5G/6625-99-4160254 (See Note 1)	Battery capacity tester (RE 4000C)
6130-99-6134575	Type 2 Battery Capacity Tester
10S/6625-99-8092747	Insulation and continuity tester (Robin)
Z4/6625-99-1025387	Megohmeter (ARMY)
5QP/6625-99-1057049	Multimeter CT 498A
6625-99-4643301 (See Note 2)	Multimeter Set Fluke, Model 87-5 EX/MOD
5Q/6625-99-4347865	Voltmeter, 0-30V d.c.
5G/6625-99-4411732	Tester, cell heavy discharge
6130-01-4626840	Digital Battery Analyser (DBA)
10S/6625-99-2523606	Multimeter (Fluke, Model 25)
10S/6685-01-9830517	Digital thermometer (Fluke, Model 51)
5J/6685-99-5332622	Thermometer, 0-65°C
5J/6630-99-9575058	Hydrometer, Type B

Cont'd

TABLE 2 LIST OF TEST EQUIPMENT CONT'D

Ref No	Item
34F/4610-99-2241918	De-ioniser, Elgastat, B114
34F/6640-99-2241919	Cartridge, C114 (for use with Elgastat, B114)
5J/6140-99-4335341	Pressure leak tester

Notes

(1) These capacity test sets will be replaced by the Type 2 Capacity Tester (6130-99-6134575).

(2) Multimeter Set Fluke, Model 87-5 EX/MOD (6625-99-4643301) is an AETEX Zone rated item specifically for use in Zone 1 areas and Battery Charging Rooms.

TABLE 3 LIST OF MATERIALS

Ref No	Item
33C/6810-99-2203018	Acid, dilute sulphuric, SG 1.270
5J/6116-99-6578788	Earthenware jar
40D/6135-99-1224574	Dyclad bag
33C/6640-99-2202225	Litmus paper, red (Alkali)
33C/6640-99-2243602	Litmus paper, blue (Acid)
34B/9150-99-9431548	Petroleum jelly, PX 6
34B/9150-99-9100488	Petroleum jelly, PX 7
33A/8010-99-9434481	Paint, anti-acid, alkali, black
33A/8010-99-9428707	Paint, anti-acid, alkali, yellow
5J/6140-99-6282241	Vent cover, battery, with hole
6140-99-8057988	Vent cover (balloon type)
33C/6505-99-2101956	Sodium bicarbonate
33C/6810-99-2244391	Boric acid crystals

TABLE 4 LIST OF EQUIPMENT AND SUPPLIERS

Supplier	Item
Key Industrial Equipment Ltd 0845 6040660	Polythene modular spill deck
Key Industrial Equipment Ltd 0845 6040660	Counter top tray
SBA Ltd 01733 897788	PVC strips

CHAPTER 2

GROUND USE BATTERY MAINTENANCE

CONTENTS

POLICY

GENERAL

MAINTENANCE PROCEDURES

GROUND USE BATTERY DOCUMENTATION

AIRCRAFT BATTERIES DESIGNATED FOR GROUND USE ONLY

TRANSPORTATION OF BATTERIES

POLICY

NOTE

Specific details of aircraft battery charging and maintenance are contained in AP 113C-0001-1

INTRODUCTION

1. The instructions contained in this chapter define the policy for the management and maintenance of Ground Use Batteries (GUB) introduced into service to support the UK Military Air Environment (MAE). The provisions of this chapter apply equally and in all respects to military personnel, MOD employed civilian staff and employees of civilian contractors engaged in the use, management of GUB at all levels. The policies laid down in this chapter are issued under the authority of the Director General Logs Strike (DG Logs (Strike) as delegated by the Chief of Defence Logistics (CDL). These policies apply to all MOD Formations, Front Line Commands (FLCs) and Stns/Ships/Units responsible for all engineering matters relating to GUBs.

2. The instructions contained in this chapter refer only to batteries procured for and installed in MOD owned GSE/MT. 'White fleet' and batteries installed on equipment supported by contractors are not to be maintained unless specifically authorised by Authority Level J.

MANDATORY REQUIREMENTS

3. Prior to undertaking any work directed by this publication, personnel must read the warnings and cautions contained within this publication. In addition, all personnel who operate or maintain Ground Support Equipment (GSE) and MT must comply with the requirements of JAP 100E-10 and AP 119F-0001-5F.

PUBLICATIONS

4. This publication has been produced for use within the RAF and all the associated publications quoted in the preliminary pages are either of RAF or Joint Service origin. However, where this publication is authorised for use within the other branches of MOD, Line Managers are to ensure that the appropriate authoritative publications equivalent to those detailed at in the preliminary pages are available.

TRADES AND SKILL LEVELS

5. RAF trades and skill levels have been prescribed in this publication and both Service and civilian equivalents apply. The attention of Line Managers is drawn to JAP 100E-10 Chap 6.11, and JAP 100A-01 Chap 0.3, Para 5.4 and Chap 4.3.

GENERAL

INTRODUCTION

6. The useful life of a battery can be defined as the number of charge/discharge cycles that can be performed before the capacity is reduced to an unacceptable level. Three factors determine the useful life, namely the construction/design of the battery, the conditions under which the battery operates and the maintenance. The design/construction and operating conditions are matters that are outside the scope of the maintenance tradesmen; therefore, the useful life of a battery is determined primarily by the quality of the maintenance. This is particularly true of lead-acid batteries that are susceptible to sulphation, but can have a long and useful life with regular and adequate maintenance. Ground Use Batteries (GUBs) that enter service for the first time are to be given a 'Commissioning Maintenance' after which they are to receive 'Routine Maintenance' on a regular basis.

COMMISSIONING MAINTENANCE

7. Every new battery requires careful preparation during commissioning maintenance to achieve a fully active state. The details of preparation vary with different types of battery; however, the manufacturer in the form of a tie-on tag or label usually supplies full instructions. These instructions are to be complied with in every detail. The 'Commissioning Maintenance' of a battery is the most important maintenance that the battery receives and the effectiveness with which this maintenance is carried out determines the effectiveness and useful life of the battery as a source of electrical power. During commissioning maintenance, the following operations will usually be required to be carried out:

7.1. Examination for damage.

7.2. Issue of serial number where appropriate.

7.3. Raising RAF Form 3924.

7.4. Filling with electrolyte where appropriate.

7.5. Charging of the battery.

7.6. Adjustment of electrolyte where required.

7.7. Preparation for issue.

ROUTINE MAINTENANCE

8. 'Routine Maintenance' is carried out on GUBs, both lead-acid and alkaline, to ensure that the battery receives a regular charge and that the physical condition of the battery is regularly monitored. Routine maintenance is to be carried out if a battery has been subject to short-term storage or when a battery is received into a BCR from a user section. The following operations will be required:

8.1. Examination for damage.

8.2. Cleaning of the battery.

8.3. Entry of details on RAF Form 3924 as specified in Para 32.

8.4. Charging of the battery.

8.5. Checking of the Electrolyte level.

8.6. Preparation for issue.

9. Stored wet charged vented batteries are to be routinely checked on a 28 day cycle for Open Circuit Voltage (OCV). If the OCV falls below 12.5V (6.25V for a 6 volt battery) the battery is to be given a refresher charge. If a battery passes the OCV check, the battery is to be checked every 28 days until the battery is considered ready for a refresher charge.

10. MF/SLAB batteries are to be routinely checked on a 28 day cycle for Open Circuit Voltage (OCV). If the OCV falls below 2.05V per cell, the battery is to be given a refresher charge. If a battery passes the OCV check, the battery is to be checked every 28 days until the battery is considered ready for a refresher charge.

11. Only those batteries identified locally as Mission Critical (those required for example emergency vehicles) may be stored ready for use. All other GUBs, with the exception of those batteries required for deployed use, are to be subject to the normal procurement (stores demand/LPO) process when discovered in an unserviceable state.

12. Each of the above operations are listed in the Standard Practices (SPs) in Chapter 3. Annexes A and B to Chapter 3 contain the sequence of operations for lead-acid and alkaline batteries.

NOTE

Routine charging of lead-acid and alkaline batteries in the absence of any manufacturer's instructions, or relevant Publication, is to be carried out at the 0.1C (C/10) rate.

13. For maintenance free batteries, refer to SP G, Chapter 3.

ADDITIONAL MAINTENANCE

14. The instructions contained in all parts of this publication do not absolve personnel from responsibility for acting upon circumstances that may come to their notice indicating the need for additional maintenance.

BOOST CHARGING

15. Boost charging is not permitted under any circumstances on lead-acid batteries and equipment is not to be modified for this purpose.

DISCHARGED BATTERIES

16. Discharged batteries are not to be left in a discharged condition; they are to be recharged as soon as possible.

CLEANING BATTERIES

17. It is important to clean batteries to minimise the effort required at maintenance intervals in recognising defects, leaks and to contribute to the efficiency of the battery room. SP B, Chapter 3, refers.

MAINTENANCE PROCEDURES

LEAD-ACID BATTERIES (INCLUDING LOW MAINTENANCE BATTERIES)

Maintenance sequence

18. The maintenance sequence listed in Annex A to Chapter 3 is to be adhered to during the maintenance of lead-acid GUBs not in use.

Electrolyte

19. The electrolyte of lead-acid batteries and the specific gravity (SG) is as follows:

19.1. Electrolyte (dilute sulphuric acid) is available in varying strengths under different reference numbers in Section 33C. Dilute sulphuric acid of SG 1.270 is always to be used in the absence of manufacturer's instructions. The mixing of electrolyte is to be carried out as follows:

19.1.1. Protective clothing is to be worn in accordance with the safety precautions referred to in Chapter 1.

19.1.2. A clean glass or glazed earthenware container is to be used that is capable of holding twice the required amount of electrolyte.

19.1.3. A test is to be carried out for alkaline contamination for using red litmus paper (33C/6640-99-2202225).

19.1.4. Dilute sulphuric acid is to be carefully added to de-ionised water, whilst the mixture is constantly stirred with a glass or ebonite rod, until the required SG is obtained.

19.1.5. When mixing electrolyte or filling batteries, a second person, who has been briefed on the actions to take in case of an emergency, is to be in attendance.

Temperature correction

20. The SG of dilute sulphuric acid decreases with a rise in temperature. Electrolyte will give a true SG reading at 15.6°C (60°F); this is known as the datum temperature. To obtain the SG at other temperatures 0.001 is to be added to the hydrometer reading for every 1.4°C (2.5°F) above the datum temperature. For values lower than the datum temperature, 0.001 is to be subtracted from the hydrometer reading for every 1.4°C below the datum temperature.

DRY CHARGED BATTERIES

Maintenance sequence

21. Dry charged batteries are usually charged up to 90% and should be capable of starting a vehicle one hour after filling the battery with electrolyte. Manufacturers strongly recommend that a dry charged battery should be given a 4-hour refresher charge at the normal recharge rate. If a dry charged battery is put into service without a refresher charge, the electrolyte is to be checked 30 minutes after filling; the temperature at this stage is not to have increased by more than 5.6°C (10°F) and the SG is not to have fallen by more than 10 points; that is to say, if acid at an SG of 1.260 is used for filling, the SG is not to have fallen below 1.250 after 30 minutes. If either of these limits has been exceeded, the battery is not to be put into service without a refresher charge. The rise in temperature when the acid is poured into the battery is an indication of the extent of self-discharge. With an old battery the rate of filling will have to be controlled to avoid overheating. After initial filling, a dry charged battery is to be maintained in the normal manner and requires no special treatment.

LOW MAINTENANCE BATTERIES

Maintenance sequence

22. Low maintenance batteries are based on the same electro-chemical principle as traditional lead-acid batteries. They are usually of the flooded electrolyte type and the case is designed to hold more electrolyte than is needed by the rated capacity of the batteries. This excess electrolyte negates the need to top up the battery with distilled water on a periodic basis, however, this does not alleviate the requirement of tradesmen to examine the battery at maintenance intervals, or when excessive overcharging has occurred. For charging instructions refer to SP E, Chapter 3.

NOTE

When removing the battery case protective clothing is to be worn in accordance with the safety precautions specified in Chapter 1.

ALKALINE BATTERIES

Maintenance sequence

23. The maintenance sequence listed in Table 3 is to be adhered to during the maintenance of not in use alkaline GUBs. For charging instructions refer to the appropriate Standard Practices in AP 113C-0001-1.

SEALED LEAD-ACID BATTERIES

Caution

BATTERY DAMAGE. Topping up of battery electrolyte in sealed lead acid batteries is not possible and must not be attempted.

Maintenance sequence

24. The majority of sealed lead-acid batteries utilise two main systems:

24.1. The absorbed electrolyte system. In the absorbed electrolyte system the acid is injected through the ventilating hole after the plates have been assembled. Separation of the plates is achieved by felt separators that absorb and contain the electrolyte, preventing it from escaping. The self-sealing valve ensures that in the event of the battery being overcharged, excess pressure can be vented.

24.2. Gas recombination principle. These batteries are normally of the starved electrolyte system whereby there is no free electrolyte. The cell plates are typically of narrow cross section, large surface area and separated from each other by a separator manufactured from a flat micro porous glass fibre material. This separator material holds sufficient acid on the fibres to allow the battery to function. Between fibres are sufficient gas spaces to allow oxygen generated at the positive plates (on constant current overcharge), to pass through the separator material. This oxygen Electro-chemically recombines on the negative plates, regenerating water. The close proximity of the large surface area plates to each other allows the battery to be discharged at high rates while still maintaining usable voltage and capacity. The batteries incorporate a safety relief valve designed to release excess gas pressure.

25. For charging instructions refer to SPF Chapter 3.

RECHARGEABLE NICKEL-CADMIUM BATTERIES

Maintenance sequence

26. Rechargeable nickel-cadmium batteries are used on various electrical and test equipment. All batteries are supplied with only a residual charge and are to be charged at the continuous charge rate before use. Rechargeable nickel-cadmium batteries have an equivalent size to popular dry cell battery sizes, for example, PP9, PP3, AAA, AA, C and D. They have, however, higher capacity and discharge rates. They will operate over a wide temperature range and are capable of accepting long-term overcharging when used with the recommended chargers. The cells have very low internal resistance, and are to be charged from a constant current source.

Charging instructions

27. A general-purpose charger with a range of plug in adapters is to be used to charge PP3 batteries and D, C, AA and AAA cells. PP9 batteries plug directly into the charging unit, whilst the single cells are inserted into adapters that plug into one another. A total capacity of 16Ah or a maximum of 32 cells may be charged in this way. Internal circuitry in the adapters limits the charge currents to 400mA (D cell), 200mA (C cell), 50mA (AA cell) and 15mA (AAA cell) resulting in a charge time of 16 hours. The charge rate of the PP3 is 9 mA (charge time 17 hours).

28. The charger and adapters are listed in Table 1.

TABLE 1 CHARGERS AND ADAPTORS

Ref No	Part No	Description
5P/6130-99-7970654	591-714	Charger, input 240V, 50Hz
5P/6150-99-7970653	591-720	D adapter
5P/6130-99-4960555	591-736	C adapter
5P/6130-99-8311848	591-742	AA adapter
5P/6130-99-8771253	591-758	AAA adapter
5P/6130-99-7382000	592-060	Single N adapter

GROUND USE BATTERY DOCUMENTATION

Introduction

29. The instructions contained in the following paragraphs relate to GUBs and are for the guidance of BCR NCOs and supervisors.

MANAGEMENT OF GUBs

30. The management of all GUBs is the responsibility of the BCR NCOs and supervisors and that person is to ensure that:

30.1. All turnaround GUBs that are P and L Stores are held on the BCR inventory.

30.2. A unit register of batteries by serial number is maintained. The unit serial number is to be formulated and allocated in accordance with para 35 and Annex A to this chapter.

30.3. The unit serial number is recorded on each end of the battery in 25mm high letters.

30.4. Each GUB has an individual record card (RAF Form 3924).

SCRAPPED GUBs AND GUBs THAT LEAVE THE UNIT

31. When a Ground Use Battery is scrapped, or leaves the unit on transfer or loan the following actions are to be taken:

31.1. **Scrapped batteries**

31.1.1. Remove the serial number from the battery and destroy all record cards.

31.1.2. Re-issue the number (if required) to a new battery and complete the relevant documentation.

31.2. **Batteries on transfer**

31.2.1. A unit receiving a battery is to request the record cards from the parent unit.

31.2.2. The receiving unit is to replace the original serial number with their own unit serial number.

31.3. **Batteries on loan**

31.3.1. Batteries on loan are to be controlled by the parent unit.

31.3.2. A battery is not to be scrapped unless the parent unit is informed.

GROUND USE BATTERY RECORD CARD, RAF FORM 3924

32. The GUB Record Card, RAF Form 3924, which may be adapted to be used electronically, is to be completed using blue/black ink or blue/black ball pen and is to conform with the following instructions:

32.1. The RAF Form 3924 is to have the battery type, date of manufacture, initial charge date (and manufacturer's serial number, if indicated), entered in the appropriate spaces.

32.1.1. To assist in the ready identification of specific capacities of individual batteries it is recommended that AH ratings and voltages be identified by inserting a colour-coded box in the top left hand corner of the MOD F3924 as illustrated in Fig 1. Battery voltages can be identified by using the codes in para 35.3 of this chapter.

Colour Code **Ground Battery Record Card** **RAF Form 3924** (Revised Jan 90)

Unit Serial No		Battery Type		Sect/Ref No		Manufacturer Date		Initial Charge Date	Maker's Serial No	
Date		CRO's Initials	Supvr's Initials	Pre – issue Load Test		Issued to Veh/GSE No	Issue Date	Recipient		
Received	Off Charge			CRO's Initials	Supvr's Initials			Signature	Name (Blk Caps)	Section

Fig 1 Example Colour Coded Ground Battery Record Card (front)

32.2. The RAF Form 3924 is to be completed under the following headings:

32.2.1. Date Received. (Column 1). Enter the date the battery is received into the BCR for maintenance, or when a refresher charge is required

32.2.2. Date Off Charge. (Column 2). Enter the date the battery is removed from charge.

32.2.3. CRO's Initials. (Column 3 and 5). Charging Room Operator (CRO) is to initial column 3 when the appropriate SPs A to I, Chapters 3-1 to 3-6, have been completed. The CRO responsible for the pre-issue load test is to initial column 5 on completion of SP N, Chapter 3-7.

32.2.4. Supervisor's Initials. (Column 4 and 6). Supervisors are to initial column 4 when they have supervised and/or satisfied themselves as to the quality and completeness of the maintenance. Column 6 is not to be initialled until a pre-issue load test (SP N, Chapter 3-7) has been carried out.

32.2.5. Issued to Veh/GSE No. (Column 7). Enter vehicle registration number or MT Fleet No, Ground Support Equipment serial number or section that the battery is issued to.

32.2.6. Issue Date. (Column 8). Enter date the battery is issued to a section or vehicle/equipment.

32.2.7. Signature of Recipient. (Column 11). The recipients are to sign for receipt and enter their names and sections in block capitals in these columns.

33. Record cards for batteries that have been charged are to be housed in a locally manufactured container with 28 compartments. Cards are to be rotated through a 28-day cycle to enable a check to be carried out on the open circuit voltage (OCV) of the battery. If a battery passes the OCV check, the card is to be returned to the container and subsequently checked every 28 days until the battery is considered ready for a refresher charge.

33.1. If the OCV falls below 12.5V on stored wet charged vented batteries, the battery is to be given a refresher charge.

33.2. If the OCV falls below 12.5V on MF/SLAB batteries the battery is to be given a refresher charge.

34. Cards for in-use batteries are to be stored in numerical order.

UNIT SERIAL NUMBER

35. A four element Unit Serial Number is to be allocated to each battery appearing on the register of GUBs, for example, BZN/50/A/17. The four elements are:

35.1. A unique group of letters to indicate the unit, for example, BZN = Brize Norton. A list of mandatory unit codes is shown in Annex A to this chapter.

35.2. A number equivalent to the battery capacity, for example, 50 = 50Ah.

35.3. A single letter to indicate the battery voltage (A = 4V, B = 6V, C = 12V and D = 24V).

35.4. A number to denote the position of the battery in a generic numerical sequence.

36. The Unit Serial Number BZN/50/A/17, indicates that the battery to which it has been allocated is the 17th, 50Ah, 6V battery to be registered at Brize Norton.

NOTE

RAF Form 3925 historically was used to provide a ground use battery master list; the RAF Form 3925 is no longer available. A suggested format for ground use battery master list is at Fig 2. The form may be used in an electronic format.

Station:	*RAF WITTERING*	Battery Type(s):	*624* *622*	Nato Stock Number	*6140-99-7894561* *6140-99-8978246*
Unit Code	*WIT*	Capacity	*105*	Battery Voltage ID	A/B/C/D*

*Delete as applicable

Battery Number	Date of I/C Date Received	Battery Type	Battery Number	Date of I/C Date Received	Battery Type
1	*12 Apr 02*	*624*			
2	*Spare*				
3	*30 Oct 05*	*622*			
				Battery Series	*WIT/A/108*

Fig 2 Example Master Battery Record Card

Date		CRO's	Supvr's	Pre-issue Load Test		Issued to	Issue	Recipient		
Received	Off Charge	Initials	Initials	CRO's Initials	Supvr's Initials	Veh/GSE No	Date	Signature	Name (Blk Caps)	Section
1	2	3	4	5	6	7	8	9	10	11

Ground Battery Record Card

RAF Form 3924
(Revised Jan 90)

Unit Serial No	Battery Type	Sect/Ref No	Manufacturer Date	Initial Charge Date	Maker's Serial No

Date		CRO's	Supvr's	Pre – issue Load Test		Issued to	Issue	Recipient		
Received	Off Charge	Initials	Initials	CRO's Initials	Supvr's Initials	Veh/GSE No	Date	Signature	Name (Blk Caps)	Section

Fig 3 Example ground battery record card (front)

Date		CRO's Initials	Supvr's Initials	Pre – issue Load Test		Issued to Veh/GSE No	Issue Date	Recipient		
Received	Off Charge			CRO's Initials	Supvr's Initials			Signature	Name (Blk Caps)	Section

Unit Serial No	Battery Type	Sect/Ref No	Manufacturer Date	Initial Charge Date	Maker's Serial No

Fig 4 Example ground battery record card (back)

AIRCRAFT BATTERIES DESIGNATED FOR GROUND USE ONLY

Introduction

37. To achieve maximum flexibility and economy, some aircraft batteries with reduced performance may be designated for 'GROUND USE ONLY'. AP 113C-0001-1 denotes the criteria relating to the application of Ground Use Only batteries.

TRANSPORTATION OF BATTERIES

Introduction

38. The need to transport filled/unfilled batteries varies from unit to unit. However, batteries that are to be transported are to be carefully prepared to eliminate the risk of short-circuiting and spillage of electrolyte. Physical protection of batteries not fitted in equipment/vehicles will also need to be provided.

39. Batteries are to be prepared for transport in accordance with SPM Chapter 3-8.

PREPARATION REQUIREMENTS

40. Batteries that are to be transported in a filled condition are to be given a refresher charge prior to despatch.

LITHIUM BATTERIES

41. Lithium batteries are covered by International Civil Aviation Organisation (ICAO) and International Air Transport Association (IATA) regulations, and only the following can be transported in passenger or cargo aircraft:

41.1. Hermetically sealed cells containing less than 0.5 grams of Lithium.

41.2. Hermetically sealed batteries containing aggregate quantities not greater than 1.0 gram of Lithium.

42. The carriage of Lithium batteries in cargo aircraft, other than those in paras 41.1 and 41.2, is to be in accordance with the current edition of IACO technical Instructions. Before the dispatch of Lithium Cells, or batteries, the consignor is to consult the current instructions regarding the transportation of Lithium batteries.

TABLE 2 LEAD ACID GUB MAINTENANCE SEQUENCE

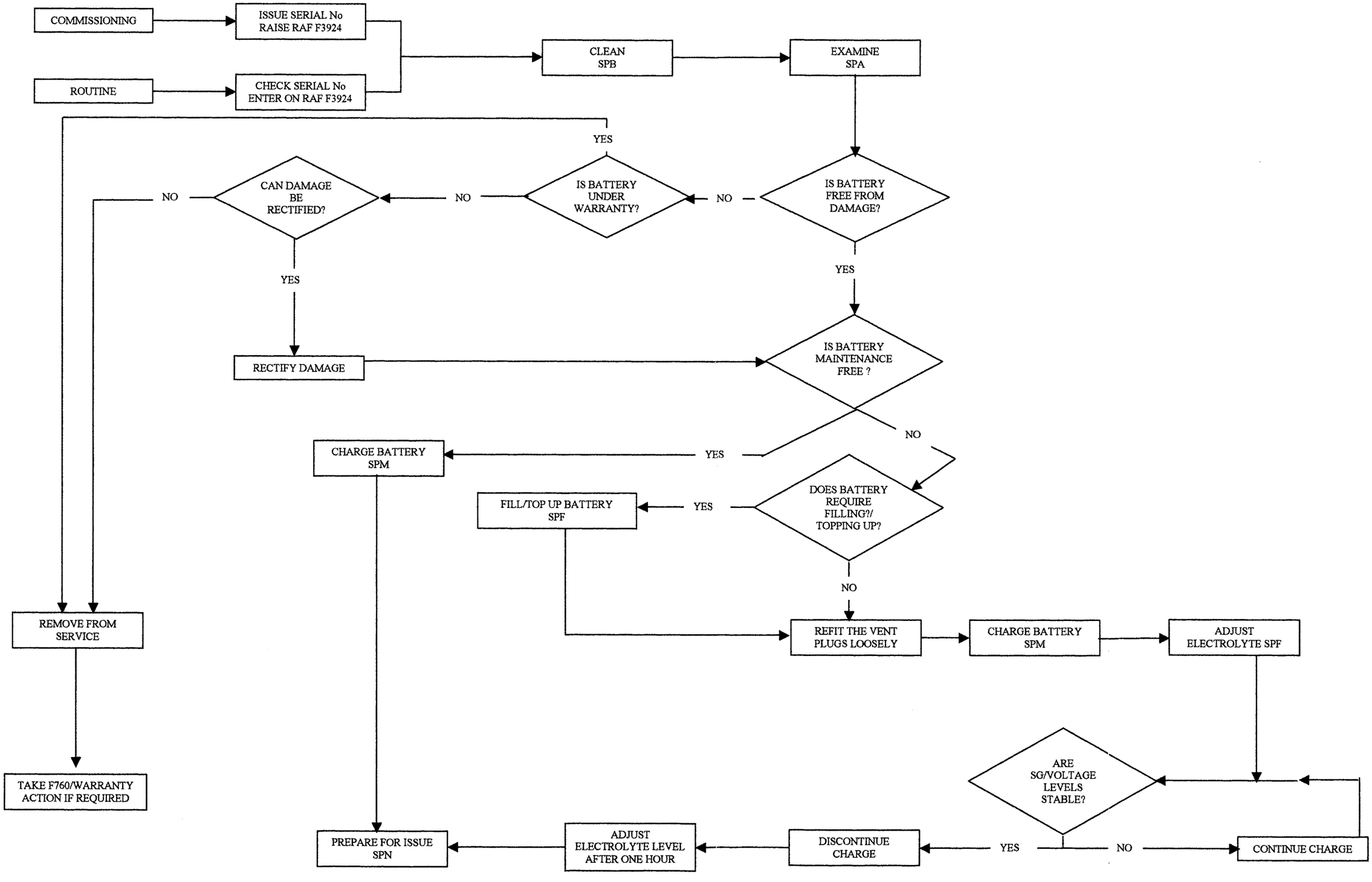
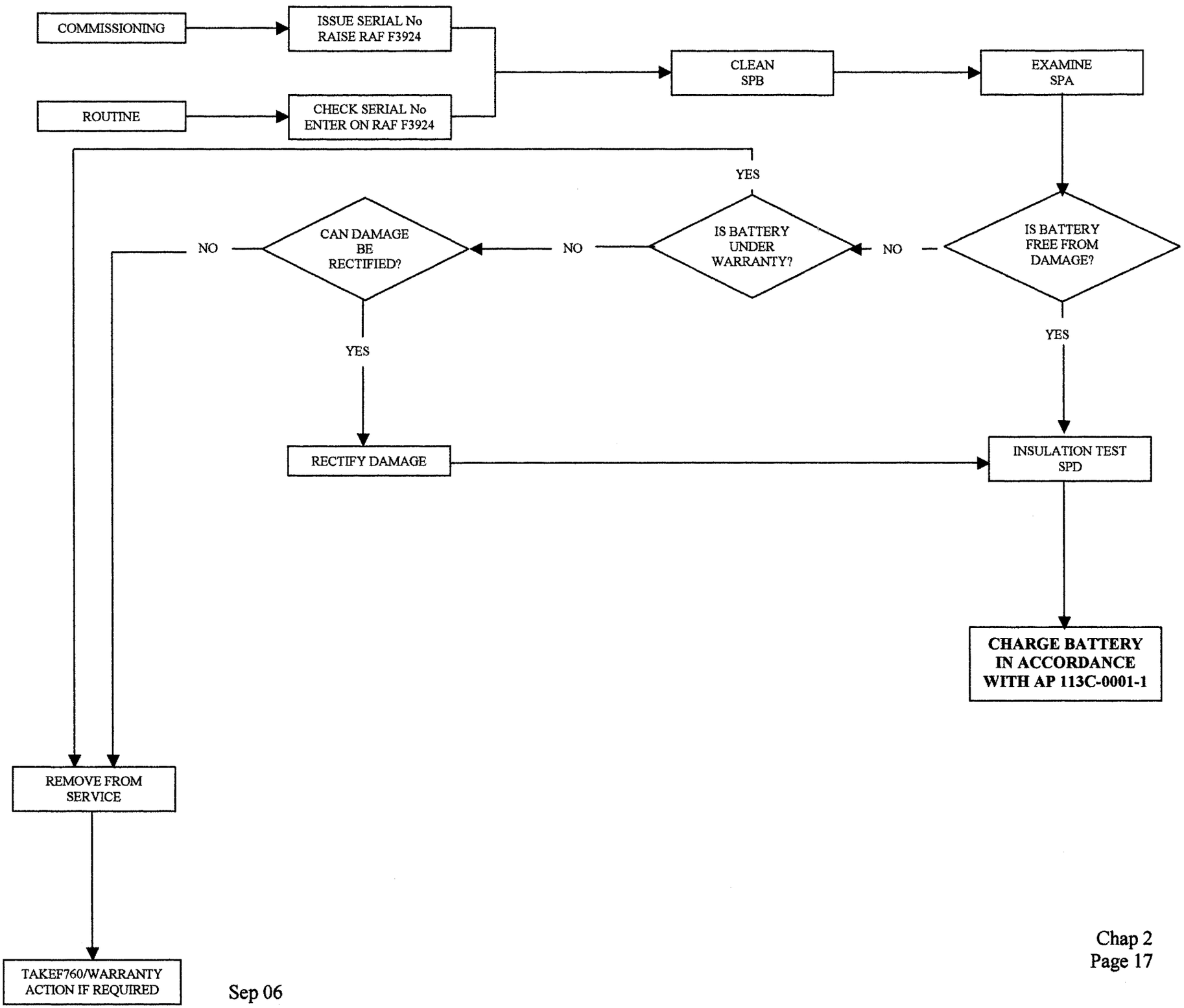


TABLE 3 ALKALINE GUB MAINTENANCE SEQUENCE



CHAPTER 2 ANNEX A

LIST OF MANDATORY UNIT CODES

Unit	Code	Unit	Code
Akrotiri	AKR	Leeming	LEE
AFCENT	AF	Leuchars	LEU
Aldergrove	ALG	Linton-On-Ouse	LIN
Al Udied AB Qatar	AUD	Lossiemouth	LOS
Ali Al Salem	AAS	Lyneham	LYN
Al Kharj	JUR	Marham	MAR
Air Port of Disembarkation (APOD) Basrah	BAS	Middle Wallop	MW
APOD Pristina	PTA	Mona	MA
Arborfield	AF	Mount Pleasant	MPA
Ascension	ASI	Netheravon	NV
BATSUB (Belize)	BC	Nimrod Major Servicing Unit	NMSU
BATUS	MH	Nimrod Support Group	NSG
Benson	BEN	Norhorn	ND
Bentley Priory	BPY	Northolt	NOR
Boscombe Down	BOS	Northwood	NWD
Boulmer	BMR	Oakhanger	OH
Brampton	BPN	Odiham	ODI
Brize Norton	BZN	Prestwick	PW
Bruggen	BU	Rheindahlen	RD
Brunei	BI	Rudloe Manor	RM
Chivenor	CHI	Scampton	SCA
Coltishall	CTS	Shawbury	SHA
Coningsby	CON	St Athan	MSA
Cosford	COS	St Mawgan	STM
Cottesmore		Spadeadam	SD
Cranwell	COT	Stafford	SFD
Culdrose	CRN	Stanbridge	SR
Digby	CU	Staxton Wold	SW
Dishforth	DA	Strike Command Operational Evaluation Unit	SAOUE
Donna Nook	DF	Stornoway	SN
Episkopi	DN	Swanton Morley	SO
Gibraltar	EP	Sultan	SU
Goose Bay	GIB	Syerston	SYN
Gutersloh	GBY	Tain	TA
Halton	GU	Topcliffe	TP
Headley Court	HAL	Upavon	UV
Hendon	HC	Uxbridge	UX
Henlow	HD	Valley	VAL
High Wycombe	HNL	Waddington	WAD
Honington	HWY	Wattisham	WAT
Incirlik	HT	Wilton	WI
Innsworth	WAR	Wittering	WIT
Kinloss	INS	Woodvale	WV
Leconfield	LEC	Wyton	WYT

LIST OF UNIT MANDATORY UNIT CODES (continued)

Army Units

Unit	Code
1 Regiment (Regt) AAC Workshop (Wksp)REME	01
UK Aviation Squadron (Sqn)	03
3 Regt AAC Wksp REME	05
4 Regt AAC Wksp REME	07
7 Regt AAC/6Flight (Flt) AAC (V) (Contractor)	10
12 Flt AAC (Contractor)	11
7 Regt AAC Quarter Master Technical (Airfield Services Netheravon)	13
9 Regt AAC Wksp REME	15
7 Regt AAC Light Aid Detachment (LAD) REME/3 Flt AAC (V) (Contractor)	17
657 Sqn AAC	18
847 Naval Air Sqn LAD REME	19
667 (Demonstration and Trials) Sqn Director Army Aviation	20
School of Army Aviation	21
7 Regt/658 Sqn AAC (V) (Contractor)	22
Apache Contract Maintenance	23
16 Flt AAC	25
7 Flt Equipment Support Section REME	28
5 Regt AAC Wksp REME	30
AAC Flt British Army Training Unit Suffield	31
70 Aircraft Wksp REME (Contractor 1st and 2nd Line)	32
70 Aircraft Wksp REME	33
7 Battalion REME	34
7 Regt AAC (V) (Contractor 666 Sqn)	35
School of Electronic and Aeronautical Engineering	38
Rotary Wing Support Group	39
25 Flt AAC Belize	40
8 Flt AAC LAD REME	42
Non-AAC Units	44

CHAPTER 3-3

STANDARD PRACTICE E

BATTERY CHARGING

CONTENTS

WARNING

(1) WHEN HANDLING OR CARRYING OUT MAINTENANCE ON BATTERIES PERSONNEL ARE TO WEAR PROTECTIVE CLOTHING. REFER TO THE PRELIMINARY PAGES OF THIS PUBLICATION.

ALKALINE BATTERIES

1. Alkaline batteries are to be charged in accordance with the relevant Standard Practices in AP 113C-0001-1.

SEALED LEAD ACID BATTERY CHARGING

2. Battery charging procedures for Sealed Lead Acid Batteries (SLABs) are detailed in Standard Practice I.

FLOODED LEAD ACID BATTERY CHARGING (INCLUDING LOW MAINTENANCE BATTERIES)

3. Flooded lead acid batteries, principally because of their construction cannot be recharged in the same manner as alkaline batteries. Consequently, when constant current charging techniques are adopted for the bay servicing of batteries, generally the 0.1C (C/10) rate is to be used.

VOLTAGE CHECKS

4. Battery terminal voltage checks are to be made periodically throughout the charging cycle, but more frequently as the battery nears the fully charged state. A battery is considered fully charged when 6 consecutive stable voltage readings, taken at half hourly intervals, are obtained. These readings are not critical and significance to two decimal places is not required, therefore any good moving coil meter can be used, for example, the Multimeter CT 498A (5QP/6625-99-1057049).

SPECIFIC GRAVITY CHECKS

5. Periodic Specific Gravity (SG) readings are to be taken where possible throughout the charging cycle of a battery. More frequent readings are to be taken towards the end of charge, for example, every 15 minutes. SG checks are, where possible, to be carried out concurrently with voltage checks. Low SG in an individual cell indicates a unserviceable cell. The battery is to be disposed of in accordance with chapter 1, para 21.

WARRANTY ACTION

6. Warranty action should be taken if a new battery does not attain the minimum specified voltage during the commissioning cycle.

NOTE

SLAB and flooded lead acid batteries must be fully charged (unless a fault precludes charging) before being returned for fault investigation.

TEMPERATURE

7. Unless stated otherwise, the temperature of any battery whilst on charge must not exceed 43°C (110°F). In cases where this temperature is approached, charging must be interrupted until the battery has cooled to a degree where charging can be safely recommenced.

CHAPTER 3-4

STANDARD PRACTICE F

CHECKING THE ELECTROLYTE LEVEL

CONTENTS

INTRODUCTION

WARNINGS

(1) WHEN HANDLING OR CARRYING OUT MAINTENANCE ON BATTERIES PERSONNEL ARE TO WEAR PROTECTIVE CLOTHING. REFER TO THE PRELIMINARY PAGES OF THIS PUBLICATION.

(2) BATTERY ELECTROLYTE. BATTERY ELECTROLYTE IS A HAZARDOUS SUBSTANCE. REFER TO THE BATTERY ELECTROLYTE WARNING IN THE PRELIMINARY PAGES OF THIS PUBLICATION.

NOTE

Reference should be made to the operating data (where provided) for information concerning the level of electrolyte in a battery. Some batteries require 'topping up' before being charged whilst others require an electrolyte level check after charging.

1. A cell should contain a precise quantity of electrolyte. During a routine inspection the amount of electrolyte in that cell may be correct even though the level is not visible.

NOTE

Individual battery manufacturers electrolyte levels vary; however, an electrolyte level of 6mm above the plates is understood to be a correct estimation. In the event that 6mm cannot be accurately measured, a visual check is to be carried out to confirm the level is just above the separator plates.

ALKALINE BATTERIES

2. Electrolyte level checks for alkaline batteries can be found in the relevant Standard Practice in AP 113C-0001-1.

LEAD ACID BATTERIES

3. The electrolyte level in each cell is to be checked as follows:

3.1. Initial filling and charging. Batteries are only to be filled with electrolyte of the correct SG in accordance with the manufacturer's instructions (where provided). The battery is to stand for six hours (unless otherwise stated) with the vent plugs loosely fitted, after which the battery is to be topped up with electrolyte of the same SG originally used for filling. Throughout the initial charging period, unless the manufacturers state otherwise, the electrolyte level is to be corrected using de-ionised water.

3.2. Routine and full maintenance. The electrolyte level is to be checked and adjusted as necessary using de-ionised water:

NOTE

Individual battery manufacturers electrolyte levels vary; however, an electrolyte level of 6mm above the plates is understood to be a correct estimation. In the event that 6mm cannot be accurately measured, a visual check is to be carried out to confirm the level is just above the separator plates.

3.2.1. After the battery has been on charge for one hour.

3.2.2. On completion of the charge, the battery is to stand for one hour before adjusting the electrolyte level; before carrying out this adjustment, the battery is to be rocked gently from side to side to release any trapped air bubbles.

DE-IONISED WATER

4. Only de-ionised water is to be used to dilute the electrolyte and 'top up' GUBs.

5. Stored de-ionised water is vulnerable to CO^2 contamination and therefore the practice of producing quantities in excess of that required for each individual battery is to be discouraged, especially when it is required for alkaline batteries.

6. De-ionised water is obtained in the RAF using the ELGASTAT B114 water purifier (34F/4610-99-2241918).

CHAPTER 3-5

STANDARD PRACTICE I

BATTERY CHARGING (SEALED LEAD ACID BATTERIES)

CONTENTS

INTRODUCTION

1. Battery manufacturers recommend that a constant voltage source should be used for charging sealed lead-acid batteries (SLABs). This is normally satisfied by the charging system fitted to the equipment/vehicle. However, in a BCR where the battery manufacturer's charging regime is not known a constant current charger should be used. The use of a constant current charger to charge a SLAB can, if not carefully monitored and regulated, result in a rise of battery voltage to above 2.5V per cell. Under these conditions excessive gassing will occur. A locally manufactured notice 'SEALED LEAD-ACID BA.TERIES ON CHARGE - VOLTAGE MONITORING REQUIRED' is to be displayed on or adjacent to, the constant current chargers used for charging these types of batteries.

BCR MANNING

2. BCRs are to be manned continuously when these types of batteries are being charged.

REFRESHER CHARGES

3. Battery condition can be determined by checking the 'off charge' terminal voltage using an accurate voltmeter. A reading of 2.05V per cell or greater indicates a fully charged battery.

VOLTMETER CONNECTIONS

4. A suitable voltmeter is to be connected across the terminals of the charger or the battery terminals. If the connection is to be at the battery, the voltmeter is to be connected permanently for the charging period.

NOTE

Crocodile clips are not to be used under any circumstances.

VOLTAGE MONITORING

5. During the charging period the voltage IS NOT to be permitted to rise above 2.5V per cell or excessive gassing will occur.

BENCH CHARGE RATE

6. The 'Bench Charge Rates' for SLABs are approximately half the value for equivalent standard batteries.

NOTES

Constant current chargers are not to be connected in parallel when charging SLABs.

In order to allow precise cell monitoring, SLABs are to be charged as individual items.

CHARGING PROCEDURES

7. The procedures for charging SLABs are as follows:

7.1. Fully discharged batteries:

7.1.1. Connect the battery and voltmeter to the charger.

7.1.2. Ensure the current control is set at the minimum position, switch on the charger and adjust the current to the maximum available with the voltmeter reading not exceeding 2.4V per cell.

7.1.3. Adjust the current until the voltage reduces to 1.16V per cell.

7.1.4. As the charge proceeds, the voltage will continue to rise and subsequent adjustments in current are required to keep the voltage at 1.16V per cell

7.2. Partially discharged batteries:

7.2.1. Connect the battery and voltmeter to the charger.

7.2.2. Ensure the current control is set at the minimum position, switch on the charger and adjust the current until the voltmeter reads 1.16V per cell.

7.2.3. As the charge proceeds, the voltage will continue to rise and subsequent readjustments in current are required to keep the voltage at 1.16V per cell.

7.3. Stopping the charge. The charge is to be stopped when the voltmeter reads 2.4V per cell and the current is reduced to the bench charge rate for the battery type. The battery is to stand for a few minutes to let the gasses disperse before disconnecting the battery from the charger and voltmeter. The state of charge can be confirmed by subjecting the battery to a short sharp discharge to remove the surface charge; the terminal voltage can then be measured. A reading of 2.05V per cell or greater, indicates a fully charged battery. Alternatively, the battery can be left to stand for several hours before measuring the terminal voltage. A reading of 2.05V per cell or greater, indicates a fully charged battery.

CHAPTER 3-6

STANDARD PRACTICE N

PRE-ISSUE LOAD TEST FOR GUBs

CONTENTS

PRE-ISSUE LOAD TEST

WARNING

(1) WHEN HANDLING OR CARRYING OUT MAINTENANCE ON BATTERIES PERSONNEL ARE TO WEAR PROTECTIVE CLOTHING. REFER TO THE PRELIMINARY PAGES OF THIS PUBLICATION.

1. All ground batteries are to receive a pre-issue load test before they are issued using the following procedures:

1.1. Connect the battery to a capacity test set, the Digital Battery Analyser (6130-01-4626840) or suitable load bank.

1.2. Note the open circuit voltage of the battery.

NOTE

SLAB batteries not rated at 12V are to be issued using the OCV criteria in SPI.

1.3. When using a capacity test set, or load bank, switch on and adjust to give a discharge at the one-hour rate. On batteries with exposed cell interlinks, Cell Tester Heavy Duty (5G/6625-99-4411732) may be used.

1.4. After 15 seconds note the battery voltage and switch off the capacity test set, or load bank.

1.5. Lead-acid batteries. If the voltage is 1.8V or greater per cell on load or the DBA indicates it, the battery is fit for issue.

1.6. Alkaline batteries. If the voltage is 1.25V or greater per cell on load the battery is fit for issue.

1.7. If the voltage is less than the limits given in paras 1.5 or 1.6, the battery is to receive a refresher charge.

1.8. Batteries that fail subsequent load tests are to be removed from service.

CHAPTER 3-7

STANDARD PRACTICE M

TRANSPORTATION OF BATTERIES

CONTENTS

INTRODUCTION

1. Damage has occurred to batteries during transportation between units, particularly when using road transport, mainly due to a lack of protective packing and/or physical restraints.

WARNING

(1) WHEN HANDLING AND CARRYING OUT MAINTENANCE ON BATTERIES PERSONNEL ARE TO WEAR PROTECTIVE CLOTHING. REFER TO THE PRELIMINARY PAGES OF THIS PUBLICATION.

ALL BATTERIES

2. There are 3 main classes of aircraft battery as follows:

2.1. Batteries wet filled with acid — UN No 2794.

2.2. Batteries wet filled with alkali — UN No 2795.

2.3. Batteries wet non spillable — UN No 2800.

NOTE

Non spillable lead acid batteries classed as UN 2800 are often described in various terms which may include:

Low maintenance

Sealed for life

Valve regulated recombination

Gelled electrolyte

Starved electrolyte

BATTERY WRAPPING

3. Only the UN 2794 and UN 2795 class of battery has a requirement to be wrapped.

4. Where the requirement exists to wrap a battery, the following information can be used as a guide:

4.1. Sufficient polythene must be used to completely contain the battery, in the event of a spillage. Care is to be taken not to use so much that the battery cannot be replaced in its housing.

4.2. Place the battery to be wrapped on a soft surface (eg cardboard) to ensure that grit or dirt cannot pierce the polythene.

4.3. Batteries are not to be 'double wrapped'.

4.4. Heavy duty polythene (0.125mm minimum thickness) or thicker should be used to wrap batteries.

PREVENTION OF DAMAGE (ROAD TRANSPORT)

5. Units responsible for the road transportation of aircraft batteries are to ensure that:

5.1. Batteries are to be individually placed into a suitable strong container with expanded polystyrene, horsehair or similar material as an insulating layer.

5.2. The container is to be marked in accordance with Poster 74, 'Marking of Containers for Transportation (General Cargo)'.

5.3. The packaged container is to be properly restrained to prevent movement within the vehicle.

5.4. Due care is to be exercised when loading and unloading the container due to the weight of the contents.

5.5. Batteries are to be loaded individually and stowed on felt on the floor of the vehicle in a single layer. They are to be securely battened to prevent movement.

PACKING MATERIALS FOR ROAD TRANSPORT

6. Suggested packaging materials are identified as follows:

6.1. Bag Battery Storage 660mm x 460mm x 380mm, 6135-99-1224574

6.2. Plastic material cellular polystyrene:

6.2.1. 15mm thick, 9330-99-2242318

6.2.2. 25mm thick, 9330-99-2242319

6.2.3. 20 mm thick, 9330-99-2242320

6.3. Rubber Sheeting

6.3.1. 1800mm long x 900mm wide x 25mm thick, 9330-99-2203418

6.3.2. 1800mm long x 900mm wide x 50mm thick, 9330-99-2203419

AIR/RAIL/SEA TRANSPORT

Note.

With respect to air transport, the 'dri clad' bag is not recognised by civilian aircraft operators or IATA Regs. However, military carriers (Lyneham and Brize Norton) may accept them for transport on military aircraft.

7. Reference, in the first instance is to be made to Unit Supply Staff when transporting batteries by air, rail or sea.

CHAPTER 3 ANNEX A

SAFETY PRECAUTIONS FOR LEAD-ACID BATTERIES

1. Every battery charging room is a potentially dangerous location. The conduct and actions of all personnel are to be governed accordingly.

2. Protective clothing is to be worn at all times.

3. Barrier cream is to be used at all times.

4. Smoking is not permitted within a battery charging room.

5. Metal watchstraps and jewellery are not to be worn in a battery charging room.

6. Naked lights, matches and lighters are not to be brought into a battery charging room.

7. Tools, hydrometers and syringes are to be kept free from acid when not in use.

8. All tools and equipment used for lead-acid batteries are to be colour coded RED.

9. In the event of an acid spillage, the excess electrolyte is to be soaked up using sand, which is to be removed before treating the area with a saturated solution of Sodium Bicarbonate. The area is then to be washed down using a mop and bucket. The contaminated area is to checked with litmus paper; clean-up operations are to be carried out until the litmus paper indicates no contamination.

10. Contaminated water or electrolyte is not to enter the main drains.

11. Contaminated sand/water is to be stored in a caged area prior to disposal by the supply squadron.

12. When mixing electrolyte never add water to acid but slowly add acid to water.

CHAPTER 3 ANNEX B

SAFETY PRECAUTIONS FOR ALKALINE BATTERIES

1. Every battery charging room is a potentially dangerous location. The conduct and actions of all personnel are to be governed accordingly.

2. Protective clothing is to be worn at all times.

3. Barrier cream is to be used at all times.

4. Smoking is not permitted within a battery charging room.

5. Metal watchstraps and jewellery are not to be worn in a battery charging room.

6. Naked lights, matches and lighters are not to be brought into a battery charging room.

7. Tools, hydrometers and syringes are to be kept free from alkaline when not in use.

8. All tools and equipment used for alkaline batteries are to be colour coded BLUE.

9. In the event of an alkaline spillage, the excess electrolyte is to be soaked up using sand, which is to be removed before treating the area with a saturated solution of Boric Acid. The area is then to be washed down using a mop and bucket. The contaminated area is to checked with litmus paper; clean-up operations are to be carried out until the litmus paper indicates no contamination.

10. Contaminated water or electrolyte is not to enter the main drains.

11. Contaminated sand/water is to be stored in a caged area prior to disposal by the supply squadron.