Barbados Civil Aviation Department

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AIRWORTHINESS

ADVISORY

CIRCULAR

CHARGING ROOMS FOR AIRCRAFT BATTERIES

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CHARGING ROOMS FOR BATTERIES

1. INTRODUCTION : This Advisory Circular gives guidance on the setting-up and operation of rooms equipped for the purpose of charging aircraft batteries. Advisory Circular AAC-020 contains information associated with the subject covered by this Advisory Circular and reference should be made to it, as appropriate.

2. BUILDNG AND EQUIPMENT

2.1. General

2.1.1. In no circumstance should the same facility be used for both nickel-cadmium and lead-acid battery charging and, the ventilation arrangements shall be such that no cross contamination can occur.

2.1.2. Buildings and rooms used for the purpose of charging batteries should be well lit and cool. They should have a ventilation system which is capable of exhausting all the gases and fumes which may be present during the servicing and charging operations. The floor surface should be of a material which is impervious to acid and alkali, has non-slip qualities and is quick drying and able to be washed down easily. Examples of such materials are dustless concrete, bituminous compound or tiling. Adequate and suitable drainage should be provided for washing down purposes. Because of the fire risk, it is strongly recommended that doors should be fitted so that they open outwards, thus facilitating easy evacuation from the building in the event of fire. To permit free and easy movement of batteries, steps and thresholds should, where possible, be eliminated. If however, different levels are unavoidable, they should be linked by inclines.

2.2. Water Supply

At least one tap in each room where battery charging is carried out should be connected to a mains fresh water supply. Sinks and draining boards and a hot water supply should also be provided.

2.3. Lighting

The level of lighting within the charging rooms should be sufficient to enable the level of the electrolyte in individual battery cells to be easily determined without additional lighting. To prevent accidental ignition of gases, all electrical fittings should be of a spark proof design.

2.4. Ventilation

Hydrogen is given off at all stages of lead-acid battery servicing, the highest concentration being at the end of the charging cycle. Hydrogen is also produced when

nickel-cadmium batteries reach the fully charged state, i.e. at the 'overcharge' point and for a 24 hour period thereafter. Heavy corrosive fumes are also emitted when mixing of electrolytes takes place. Therefore, a ventilation system is required which is capable of extracting all gases and fumes, whether heavier or lighter than air.

2.5. **Temperatures**

2.5.1. **Electrolyte Temperature.**

The maximum permissible electrolyte temperature during charging is normally 50°C (122°F) but, some batteries of special design however, have lower limits. For such batteries, the temperature limitations will be specified in the manufacturer's publication for that battery.

2.5.2. **Environmental Temperature**

Environmental temperatures exceeding 27°C (81ºF) for lead acid batteries and 21°C (70°F) for nickel-cadmium batteries, impose time penalties in reaching the fully charged state and may also be deleterious to the batteries. The temperature of battery charging rooms must therefore, be maintained at a temperature consistent with specified limitations and with a free air flow around each battery or cell.

3. CHARGING BOARDS AND BENCHES

3.1. Detailed differences exist between the various types of charging boards, but in general, each board consists of a pair of terminals, to which the rectified a.c. supply is connected (or in the case of a board which has a built-in rectifier unit, to which the mains supply is connected), together with a number of pairs of output terminals, to which the batteries are connected for charging.

3.2. All the output circuits are internally connected in parallel and are therefore, independent of each other, with the level of charge being controlled separately for each output circuit. Each pair of output terminals is normally designed to have one group of batteries or cells connected in series.

Note: Parallel connection of batteries to one pair of output terminals is not permitted.

3.3. Charging boards should be mounted directly above the rear of the benches so that the necessity for long connecting cables is avoided.

3.4 Battery connecting cables must be well insulated and must be of a sufficient capacity to carry the charging current required. The free ends of connecting cables must be fitted with suitable connectors. These must be firmly secured to the battery and charging board before commencing charging operations. Connections to the charging boards must not be made or broken when power is switched on. On completion of the charging cycle, power must be switched off and the charging cables disconnected, first from the battery and then from the charging board.

3.5. **Benches**

3.5.1. Benches and associated equipment should be sited so that the need for personnel to lean over batteries is kept to a minimum. It is recommended that the height of battery charging benches be approximately 20" from the floor. At this height, lifting strain is minimised and a more effective visual inspection of the batteries can be made.

3.5.2. The surfaces of battery charging benches must be acid and alkali resistive and must facilitate cleaning. It is generally considered that batteries must not be allowed to stand directly on wood or concrete, but must rest on suitable grids.

4. POWER SUPPLIES

4.1. Transformer/rectifiers which normally provide rectified a.c. for charging board supplies must be sited in a fume free, dry and cool position, preferably in a separate room, located as near as possible to the charging boards. Charging boards which require 240 volts mains supply, must be supplied from a ring main system.

5. STORAGE

5.1. **Batteries**

In order to preserve an orderly flow of work through a battery charging room, storage facilities should be provided such that incoming unserviceable batteries may be separated from those ready for issue, preferably in clearly placarded areas. The storage facilities should be further grouped for those batteries requiring initial charge and those awaiting routine servicing. Batteries which are serviceable and awaiting issue are best stored in an area which is not subjected to excessive vibration. It is essential that whilst in store, lead-acid batteries be segregated at all times from nickel-cadmium batteries, preferably in separate store rooms. For further information on the long term storage of batteries, reference should be made to Advisory Circular AAC-020.

5.2. **Electrolytes**

5.2.1. The handling and storage of electrolyte materials must always be in accordance with the manufacturer's instructions. It is however, essential that when undertaking the mixing or breaking down of these chemicals, separate areas are provided. Glass, earthenware or lead-lined wood containers are suitable for the storage of lead-acid battery electrolyte (sulphuric acid), whilst plain iron, glass or earthenware containers are suitable for the storage of nickel-cadmium battery electrolyte (potassium hydroxide). Galvanised containers or containers with soldered seams must not be used. Each container must be clearly marked with its contents and must be stored accordingly. Waste or surplus materials must be disposed of in accordance with locally approved instructions. If however, doubt exists, all electrolytes must be neutralised prior to disposal (paragraph 5.4). All mixing vessels, mixing rods and other similar items must be clearly marked with 'acid only' or 'alkaline only' and their use should be restricted accordingly.

5.2.2. Stocks of electrolyte materials which are retained in a battery charging room must be restricted to the quantities required for immediate use. The storing of electrolytes mixed and ready for use should be avoided as far as possible.

(a) Sulphuric acid containers should be kept tightly sealed when not in use to prevent contamination. Only the container which is required for immediate use should be retained in the charging room.

(b) Potassium hydroxide is supplied in solid form contained in steel drums. Once a drum has been opened, the contents are liable to carbon dioxide contamination. The entire contents must therefore, always be mixed as soon as a drum has been opened. Any unused mixture must be stored in a stoppered glass container.

5.3. De-mineralised and distilled water are generally supplied in carboys and should be stored separately from the electrolytes, so as to avoid contamination. Carboys should be firmly stoppered when not in use and should be clearly marked with the contents. Only the water container used for 'topping up' should be kept in the charging room and the stopper must be refitted immediately after use.

5.4. The neutralising agents for the two types of electrolytes are given below, together with the action that should be taken in the event of contamination and/or spillage.

5.4.1. **Sulphuric Acid.** The neutralising agents are:

(a) Saturated solution of bicarbonate of soda.
(b) Ammonia powder.
(c) Borax powder.

The acid should be soaked up with sawdust which must then be removed and buried. The affected area must be treated with one of the above, followed by washing down with copious amounts of fresh water.

5.4.2. **Potassium Hydroxide.** The neutralising agents are:

(a) Boric acid solution.
(b) Boric acid crystals or powder.

The alkali should be soaked up with sawdust, which must then be removed and buried. The affected area must be treated with one of the above, followed by washing down with copious amounts of fresh water.

5.4.3. Containers of sawdust and neutralising agents must be clearly marked with their contents and use and sited in readily accessible positions.

6 PROTECTION

6.1. To prevent the risk of burns, such personal items as rings, metal watches, watchstraps and identification bracelets must be removed, to avoid contact with connecting links and terminals. Personal protection against the harmful effects of

acid and alkali contamination should be in accordance with good maintenance practices and, the following items of safety apparel should be provided:

(a). Protective gloves

(b). Goggles and an eye bath.

(c). Industrial grade protective apron.

(d). Overalls.

6.2. In general, smoking must only be permitted in rooms which do not have a direct access to battery charging rooms or chemical mixing areas. Naked lights, non-safety matches and automatic lighters must not be taken into battery charging rooms.

6.3. Fire extinguishers of the CO type and buckets of sand must be placed at strategic points inside the building for use in the event of any chemical fires.

7. DOCUMENTATION

7.1. Records of battery servicing must be maintained.

8 SERVICING AND TEST EQUIPMENT

8.1. Servicing of aircraft batteries must be carried out in accordance with the instructions contained in the manufacturers' Maintenance Manual.

8.2. In addition to the general engineering hand tools which may be required for aircraft battery servicing, the following specialised items will also be required:

(a) Hydrometers.
(b) Thermometers.
(c) Battery kits (as supplied by battery manufacturers).
(d) Capacity test sets.
(e) Leakage tester (lead-acid batteries).
(f) Filler pumps (for transferring of liquids from one container to another).
(g) Calibrated test equipment:
(h) Insulation resistance tester.
(i) Universal test meter.
(j) Digital voltmeter.

8.2.1. To prevent cross-contamination between the two types of aircraft batteries, two sets of equipment must be held, each contained in separate cupboards and clearly marked "acid only" or "alkaline only ' as appropriate to the application. Wherever possible, tools and equipment comprising the sets must be those constructed of an insulating material. Each item should be identified to its application and in the case of hydrometers and thermometers, this is usually best done on the instrument case