



CHRISTIE®

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SETTING UP A NICKEL CADMIUM BATTERY SHOP

The following summary is intended to help in planning a battery shop for servicing main ship aircraft batteries. Local requirements and the type of aviation department may dictate variations in requirements. Although setting up a battery shop involves some expense, a properly outfitted shop is a minor expense compared to the capital costs of the batteries and more importantly, the cost and safety of the aircraft whose proper operation depends upon the effective maintenance of its batteries. The following paragraphs address the most significant items, some in greater detail than others. Should supplemental information be beneficial, contact the MarathonNorco Aerospace distributor in your area. For information on processing equipment for sealed batteries see the above websites.

OVERVIEW

An effective ni-cad battery shop should be:

- (a) Clean.
- (b) Well Lighted.
- (c) Well Ventilated.
- (d) Outfitted with the necessary equipment.
- (e) Supplied with adequate source of electricity, water and compressed air, as well as sufficient drains.
- (f) Provided with the appropriate maintenance manuals.
- (g) Conveniently located.
- (h) Meet all safety, health and occupancy regulations
- (i) Most importantly, staffed with trained and knowledgeable personnel.

THE SHOP

A. SIZE:

A 10'Wx10'Dx10'H shop should be the minimum size to contain all of the recommended equipment listed below. Battery processing time varies in accordance with servicing instructions provided by the battery manufacturer. Additional time may be required if batteries exhibit certain problems such as cell imbalance See the appropriate section of the charger/analyzer operating manual and the battery manual for details. In general, there should be one operator for every 3 to 5 charger/analyzers.

B. TEMPERATURE:

Battery servicing is best accomplished at temperatures most comfortable for humans (75°F/ 25° C). Air conditioning has proven to be beneficial, since it can speed up servicing and produce better batteries. Cooler batteries absorb more electrical energy during charging than do warmer ones, and thus can return more energy when required aboard the aircraft. If air conditioning is not feasible, a cooling fan can be used to remove some heat from the battery. A few suggestions for optimizing the use of the fan:

- (j) Position the fan so that the cooling airflow passes down onto the cell-links, as well as the battery case.
- (k) Place the battery on small wood blocks typically 2"x2"x2" to permit airflow under the battery case.
- (l) Direct the airflow across the battery away from the charger/analyzer.

C. LIGHTING:

Should be well distributed. Emergency battery powered lights may need to be provided in case of a power failure. Check local regulations for lighting and emergency lighting requirements.



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D. WALL/CEILING COLOR:

A light color is best for improved visibility.

E. FLOOR:

Should be washable and provided with adequate drains.

F. SECURITY:

The door should be kept closed for cleanliness and be lockable because of the high value of batteries and tools. A window in the door is beneficial. The door should open out, not in.

G. ELECTRICAL SUPPLY:

The alternating current main supply should be adequate to satisfy all charger/analyzers operating simultaneously, plus a safety factor. The RF80-M requires a maximum current input of 25 amps at 230 volts single phase. The charger/analyzer AC main supply should not be shared with other equipment.

H. COMPRESSED AIR:

An adequate oil filter should be included in the air supply line. The filter is relied upon to prevent compressor oil from passing into the cells. Compressed air is used to test the cell vent caps of some battery manufacturers. Oil on the vent caps could contaminate the cell interior and cause foaming of the electrolyte.

I. TELEPHONE:

Helpful, for communications and may be required in accordance with some safety regulations.

J. LOCATION:

Primarily because of battery weight, the shop should be on the ground floor. It should be convenient to the flight line or to the storage, shipping or receiving facilities. It should not be near metalworking shops or have ventilation ducts coming from areas where metal is ground or cut, fine metal particles can migrate into the batteries. Ventilation ducts should not be shared with painting, electroplating or other chemical processing operations.

K. EQUIPMENT

Quality equipment may have a slightly higher initial cost, but saves money in the long run. The following equipment may be required in order to service the batteries. See the battery manufacturer's manuals for further information.

- (a) **Charger/Analyzer:** The CHRISTIE RF80-M ReFLEX® charger/analyzer is the latest evolution of the well known CHRISTIE family of battery charger/analyzers. The RF80-M can process any nickel cadmium or lead acid aircraft battery. The unique advantage of ReFLEX® charging is the positive charge pulses alternating with the negative charge pulses that serve to restore cell balance, increase battery cycle life and eliminate nickel cadmium battery memory effect. The RF80-M touch screen allows the technician to program and store the exact nickel cadmium or lead acid CMM requirements for servicing any aircraft battery. The RF80-M will store up to 100 programs and each program can have up to 16 steps. Programs can be password protected. The touch screen continuously displays, in color, the function currently being performed, functions pending, battery voltage, charge/discharge current and time elapsed or remaining. Alerts can be inserted into the program to notify the technician to check, record, adjust or perform any specified CMM requirement.



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- (b) **Cell Monitoring Instrument:** The DataFX® provides a complete, hard copy battery servicing report. It scans the battery's cells during charge and discharge, measuring the voltage of each cell at fixed intervals. The voltage of each cell is presented on the display. If a fault condition occurs during the process, a warning light and audible "beep" alerts you to the problem. The display indicates the type of fault and cells involved. When used with an Epson compatible serial printer, it provides a report of the battery process data, cell voltages at various times, current level, battery voltage and error messages. The DataFX® simplifies the recording of required data.
- (c) **Water:** The replaceable component of battery electrolyte is distilled, de-mineralized or de-ionized water, typically available in sealed containers. Water should have a maximum conductivity of 200,000 ohms per cm³. For those of you in Europe, this equates to 5 micro mohs. Tap water should **never** be used.
- (d) **Shorting Clips:** These clips are used during the nickel cadmium deep discharging step. Resistor clips are also beneficial. These are both available from your MarathonNorco Aerospace battery distributor.
- (e) **Volt-Ohmmeter:** Such meters, analog or digital, are needed in the processing steps described in either the Christie or battery manufacturer's manual.
- (f) **Torque wrench:** Used to confirm that the cell links are tightened in accordance with the battery manufacturer's manual. A range of 0 – 200 inch pounds is preferred.
Note: 1 inch pound equals 0.112 newton-metres (N.m).
- (g) **Brush:** A nylon brush is handy for brushing residue from the top of the battery. **Never** use a wire brush.
- (h) **Vaseline:** This neutral coating material, sometimes called petroleum jelly, is brushed on the clean links before returning the battery to service. This is not required by all battery manufacturers or for all batteries.
- (i) **Nozzle:** Made of polystyrene and combined with a 20-50cc syringe, it serves to determine the proper cell liquid level. These are available in kits from your MarathonNorco Aerospace battery distributor.
- (j) **Visor / Eye Protector:** Beneficial because each cell contains corrosive potassium hydroxide. Always follow appropriate safety practices.
- (k) **Thermometer:** Preferably non-metallic and not containing mercury as a temperature indicator. A glass thermometer containing a colored alcohol column is preferred. This is used to obtain test data should a cell appear to be overheating. This is not required by all manufacturers or for all batteries.
- (l) **Socket wrenches:** Complete set of appropriate sizes, such as 17mm, 14mm, ½ inch, etc.
- (m) **Cell Puller:** Beneficial when replacing cells. These are available through your MarathonNorco Aerospace battery distributor.
- (n) **Shop Vac:** The 40 gallon size is very helpful, especially when used with the nylon brush while cleaning residue off of the battery link area.
- (o) **Allen type socket set:** For use on batteries with socket head cap screws. Use these in conjunction with the torque wrench.
- (p) **Nut Driver:** Helpful in starting nuts on terminals. **Not** to be used to tighten nuts.
- (q) **Strainer:** A colander-type device for ease of cleaning links and vent caps.
- (r) **Vent Plug Pressure Tester:** Helpful in determining that the plugs vent within the specified pressure range. This is required by some battery manufacturers for some batteries. Contact your MarathonNorco Aerospace for further information.
- (s) **Mechanical Timer with Audible Signal:** A helpful device when servicing many batteries simultaneously. The settable alert capabilities of the RF80-M preclude the need for other alerting devices.



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- (t) **Tape Recorder**: beneficial when scanning cells during charge or discharge. Eases the collection of data when there is only 1 person in the shop. The DataFX eliminates manual recording of data.
- (u) **Full-Body Safety Shower as well as Separate Eye Flusher**: Should be conveniently located in accordance with safety regulations.
- (v) **Fire Extinguishers**: conveniently located as per local standards, approved type, frequently inspected. Local regulations will dictate the exact requirements.
- (w) **Non-Metallic Work Surfaces**: Capable of safely holding the intended weights.
- (x) **Vent Hoods**: Preferred by some operators, especially in small tightly closed shops. The battery is placed under the hood, which provides effective air removal for venting the gases generated during topping charge. When multiple batteries are being serviced within the same room make-up air may be required.
- (y) If there is a potential for the hydrogen evolved in charging to reach the lower explosive limit of 4% forced ventilation **must** be provided. As an aid in determining the ventilation required please consider the following:
 - 1) .17166 liters per minute of explosive atmosphere is
 - 2) Evolved per cell per amp of topping charge.
 - 3) 1 cubic foot equals 28.32 liters
 - 4) No safety factor has been included
 - 5) Always ventilate for the anticipated worst case.

Example: 4 each 20 cell batteries top charging at 9.2 amps.

.17166 lpm X 9.2 ah top charge X 80 cells = 126.34 lpm of explosive atmosphere evolved.

126.34 divided by 28.32 = 4.46 cfm ventilation required **without** a safety factor. Local regulations determine safety factors.

- (z) **For Lead-Acid Batteries**: Although certain of the above items can also be used in a lead-acid shop, the items specifically required for a lead-acid shop include a hydrometer, sulfuric acid, baking soda, and a complete outfit of rubber protective clothing (apron gloves, and pants). Lead-Acid batteries and nickel cadmium batteries must never be charged and discharged within the same enclosed area.
- (aa) **FAA and EASA Regulations**: Each person performing maintenance on aircraft batteries **“shall use the methods, techniques, and practices prescribed in the current manufacturer’s maintenance manual”**. Please see FAA Advisory Circular AC 43.13 chapter 10 for further information.

L. Record Keeping

Associated with good maintenance practices is the keeping of accurate records. These records serve as a verification of the maintenance procedure and provide information for establishing optimum service schedules. When a DataFX® is not available a manually recorded battery data sheet must be used. Sample battery data sheets are included in many Marathon battery manuals.

M. Training

Battery service life and costs depend upon the quality of service the batteries receive. Only a trained technician can properly service today’s batteries. Battery manufacturers and battery distributors provide classes in the servicing of their products. Contact the manufacturer of your batteries for training information.