

The above-mentioned voltage ranges are presently under consideration by the I.E.C. The determinant, that decides whether or not a given electrochemical system fits into which voltage range, is its Standard Discharge Voltage, which is presented, and discussed in part 1.

## 2. Application to the new nomenclature

Present battery volumes from button cells to lead-acid batteries cover a range of more than four orders of magnitude. When using a double-logarithmic plot of the standard energy content  $E_s$  for batteries of a given electrochemical system versus battery volume  $V_b$ , it turned out that the logarithmically coded battery volume may serve as a base for a unique battery designation system for both primary and secondary batteries. The designation system may be expanded to also include additional physical and performance characteristics, like the load capability or special arrangements to the benefit of the battery expert or it may be abbreviated to serve the needs of the end user. The inclusion of the load capability into the nomenclature is an important feature with respect to safety, since the present nomenclature does not differentiate between, for example, a high-rate and a low-rate lithium battery.

It also allows the setting up of a logically structured data base that handles all portable batteries by system, size, shape and load capability. In principle, it addresses battery sizes from 1 mm<sup>3</sup> up to 10 m<sup>3</sup> while providing a capacity for 120 different primary plus 120 secondary systems, which should be abundant for future purposes. This nomenclature system fully complies with the requirements of the IEC/ISO Directive, part 2, of International Standardization.

The poster will have a demonstration of the capabilities of this data base.

## P23

### The development of a multi-purpose battery information system

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There is presently a lack of a complete, well-utilized, accurate database of batteries throughout the Canadian and U.S. military. Such a tracking tool could dramatically assist in reducing the proliferation of unique batteries and in serving as a designers' tool for standardizing families of batteries for particular families of systems. The battery maintenance procedures within the military organisations could be updated, and training of personnel could reduce maintenance costs. Many battery chemistries require standard, periodic, maintenance that prolong the life of the battery. If these maintenance

procedures or time intervals are not followed, battery life decreases, resulting in unnecessary maintenance or replacement costs.

This paper presents a knowledge framework for the organization of battery informational support of the life cycle management of battery systems used in the military.

## P24

### Evaluation of lithium primary cells for long-life applications

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The new types of ultrasonic domestic gas meters used by British Gas plc are significantly different from the previous self-powered mechanical diaphragm meter, in that it is powered by 'D' or 'C' - sized primary lithium batteries. A paper describing hazard evaluations of the range of lithium battery candidates was presented at the 1995 International Power Sources Symposium, and in this poster the work reported extends to cover evaluations of electrical performance and reliability of candidate cells.

The meters require reliable, continuous, operation of batteries over a period of at least 11.5 years, in both internal and external environments. Initial tests evaluated the performance of batches of batteries discharged under continuous load, at currents over the range 3 to 30 mA, under a thermal cycle designed to represent operation in the UK seasonal and diurnal climatic changes. In order to trap short-term voltage excursions and to achieve reasonable sampling rates, a 1024 channel data acquisition and control test rig and associated data processing software was developed.

To date, a range of lithium/thionyl chloride, manganese dioxide and polycarbon monofluoride cells have been tested, and base-line data have been generated for a range of batteries which characterise the voltage/temperature relationships and the effective capacity under these discharge conditions. The data are successful in identifying possible failure modes and has indicated the need for further work under pulsed loads.

## P25

### Safe and efficient charging algorithm for lithium batteries

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The Total Battery Management (TBM) charging algorithm for lithium batteries provides efficient energy transfer,