Note: See Section 27, Disposal of Used Batteries, before conducting and documenting this test.

The primary concern in battery installations is, "How much actual usable energy is stored in the battery?"

In lead acid batteries, it has been common practice to take periodic specific gravity readings with a hydrometer. This will give a relative indication of the state-of-charge of the available material. However, it does not compensate for the loss of capacity as the cell ages.

A simpler method of accomplishing the same results for either lead acid or nickel cadmium cells is to place the charger in the "equalize/recharge" mode. The charger output current will rapidly increase and the output voltage will begin to rise. Within about 1 to 2 minutes, the current will fall back to near its original level indicating the battery is fully charged and is not accepting further charge. If this does not happen, the charger should be left in the higher setting until the current does fall back to near its float level.

Both of these methods (hydrometer check and charger check) will indicate a fully-charged cell when it exists, even though the cell may have lost a major portion of its original capacity. Some users are beginning to run annual load tests on their batteries. However, this imposes some serious concerns of its own:

1. It is troublesome and time consuming.

2. A power failure at the end of a load test would leave the installation with no battery backup power, because the battery would be discharged.

A method of determining the worst case condition of the battery without jeopardizing the system is to find the weakest cell or cells in the string, and load test only these cells. If they pass, the total battery is okay. If they fail, they can be replaced before causing a major system failure.

Also, by only removing 1 to 2 cells for test, the remaining battery will still carry the load, but for a shorter time period. A step-by-step procedure is given for this test:

1. Energize any engine generator sets or whatever standby power is available to provide system protection while the battery is removed from the system.

2. Remove system load from the battery.

3. Switch the battery charger to "OFF", and/or remove the battery from the charger.

4. Apply a load across the battery that will draw current at least equal in magnitude to 15% of the AH capacity of the cells, i.e., if you are testing 100 AH cells, use at least a 15 amp load.

5. Leave this load on the battery for approximately 15 minutes.

6. After 15 minutes, with the load remaining on the battery, go down the string of cells with a voltmeter reading each cell voltage.

7. If you see any cell which deviates from the others by as much as 0.1 VDC, mark this cell for further testing.

   Note: If there were no major voltage deviations in the cells, this simply means that all cells are in approximately equal condition and any cell may be load tested. In this case, choose a cell on

the end of a string to load test, because it will be easier to remove.

8. Remove the load from the battery.

9. Reconnect the charger to the battery and recharge the battery at the "recharge" (equalize, for lead acid batteries) rate for approximately 24 hours. Shut down the equipment in Step 1 during this period, if you choose, after applying the system load to the battery charger system.

10. Repeat step 1, 2, and 3.

11. Disconnect the cell or cells marked in step 6 and jumper across them to complete the battery circuit with this cell removed

12. Reconnect the charger to the battery and the battery to the load. Note: If more than 3% of the total battery cells were removed in Step 11, the charger output "float" voltage should be re-adjusted to an appropriate voltage for the remaining cells in the battery string.

13. Take the cell or cells removed in step 11 and run a load test in accordance with your specific load profile.

Note 1: If the cell will not provide 80% of its original rated capacity as published in the vendor's data sheets, it is generally agreed to be a failed cell.

Note 2: It is best to test the battery against the actual load profile it will be called upon to carry in the event of a power outage.

This is because there may be a cell which has failed to meet the "80% of original capacity" test, but which is adequate to meet your specific load requirements. The determination can then be made, by you, whether to spend the dollars and time to have it replaced.