

Battery Evaluation and Certification Testing - Case Studies

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INTRODUCTION

Competitive pressures are forcing Operating Telephone Companies to look for opportunities that will improve financial performance by growing revenues and earnings and reducing operating and maintenance expenses. There is also pressure from regulatory agencies and consumer groups to improve the reliability of service and to minimize outages due to failures of equipment or utility power. The paper will discuss the role that Battery Performance testing can play in providing input for making decisions on reducing or delaying capital investments while assuring a high level of reliability in reusing existing batteries.

Installed switching and transmission equipment is often surplus or replaced with modern equipment that provides new revenue producing features and services with lower maintenance costs. In many cases, the equipment removed may have reliable service life remaining and efforts are made to reuse the equipment elsewhere in the network or to sell it. However, there is often a glut of used switching and transmission equipment in the marketplace and surplus equipment is often sold for its scrap value. Power plants that become surplus may be re-deployed if they are of recent vintage

or selected rectifiers, inverters, and batteries from the plants may be used in other applications to satisfy needs for growth.

The power engineer in the Operating Telephone Company plays an important role in managing capital investments for power related equipment and the power engineer also has responsibility for improving the reliability and performance of power plants in the network. Batteries represent a major percentage of power plant costs and are a critical element in maintaining the reliability of the telecommunications network. There are a number of decisions that the power engineer must make that involve information on status of batteries:

- With the early retirement of Switching equipment, should the existing strings of batteries be scrapped or can they be re-deployed in new or growth office applications;
- In locations containing switching or transmission equipment scheduled for replacement within the next few years, do the existing strings of batteries have sufficient reserve capacity to provide the minimum hold-over requirements.

This paper will address these battery related issues and examine the options available to the power engineer in making informed decisions on the capacity and performance potential of the batteries with a high level of confidence. Two recent situations that occurred in Bell of Pennsylvania will be presented as case studies to show battery capacity and performance testing as an important tool in providing reliable information for making decisions that can reduce or delay capital expenditures while assuring the reliability of the network.

EVALUATING BATTERY PERFORMANCE

Batteries play a critical role in the reliability and survivability of the telephone network. The batteries provide a source of energy if individual rectifiers fail in the plant. They are the primary power source when commercial utility power is lost and until the office generator starts or commercial power is restored. It is critical for the power engineer to have confidence in the performance potential and load carrying capacity of the installed battery. There are four options available to the power engineer for assessing the performance potential of the battery:

- Option 1: Visual inspection plus measurements of specific gravity, individual cell and battery voltage, and intercell resistance.

Visual inspection of each cell and the string will identify problems with post and cover seal integrity, corrosion, plate growth and crystallization. The measurement of specific gravity and

cell voltages can be indicators on the condition of individual cells. The measurement of intercell resistance will identify problems with corrosion or poor connections.

- Option 2: Option 1 plus Measurement of Conductance.

The additional measurement of conductance will provide some indication on the internal condition of individual cells. This option provides additional information on the performance potential of the battery. However, it does not provide information with a high confidence level on capacity of the battery for supporting the load. Battery capacity can only be determined by observing the battery string and cells under discharge conditions.

- Option 3: Option 2 plus discharge testing using office load.

Discharging the battery string through the office load provides a higher level of confidence that the batteries will support the load. This test can be done by turning off one or more of the plant rectifiers and forcing the battery to supply a portion of the load current. The discharge current and battery voltage are monitored and the resultant discharge voltage performance is compared with the specifications provided by the battery manufacturer. However, this test has a number of limitations. If the battery fails, it could take down the office. Also, the discharge current cannot be held constant as the battery voltage drops. In addition, because of operational considerations, the depth of discharge must be limited and a full capacity test cannot be run.

- Option 4: Option 2 plus controlled discharge to specified battery voltage.

This option provides the power engineer with highest level of confidence on battery capacity and performance potential. This option can also provide information on the performance of each cell in the string. The use of thermography monitoring during the discharge test will identify abnormal temperature rises in cells, connectors and distribution plant.

Figure 1 summarizes the alternatives available to power engineers for

performance potential of a battery and the relative levels of confidence for each alternative.

Figure 2 is the method of procedure flow chart used in the case studies for evaluation of battery strings for Option 4.

CASE STUDIES

This section discusses two situations that recently occurred in Bell of Pennsylvania. In each case, the power engineer had to make decisions that

ALTERNATIVES FOR ASSESSING CAPACITY AND PERFORMANCE POTENTIAL OF BATTERY STRINGS		
ALTERNATIVE	DESCRIPTION	DEGREE OF CONFIDENCE
OPTION 1	Visual Inspection, Measurements of: specific gravity, cell voltage, battery voltage, intercell resistance	Low Will not detect marginal cells
OPTION 2	Option 1 plus Measurements of : Conductance of cell	Low / Medium May identify marginal cells
Option 3	Option 1 plus Limited Discharge test through office load	Medium Depends on level of discharge
Option 4	Option 1 plus Controlled discharge at manufacturer's recommended rate to final battery voltage. Continual monitoring of battery and cell voltages with thermographic monitoring of cells and connections during discharge	High Characterizes the battery and each cell; highlights areas of abnormal thermal rise

FIGURE 1

