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ONE-DAY* STATIONARY BATTERY SIZING SEMINAR (ESA-0304)
0.7 CEUs Awarded

OUTLINE

TIME**	SUBJECT
8:00 AM - 8:15 AM	Introduction
8:45 AM - 11:30 AM	Discussion of stationary battery sizing - cell types and items to consider for the installation design
11:30 AM – 12:30 PM	**** LUNCH ****
12:30 PM – 1:30 PM	Discussion of stationary battery sizing - duty cycle development, battery sizing calculation and battery charger sizing
1:30 PM – 4:30 PM	Stationary battery and charger sizing exercises

* A two-day extended version of this seminar is also available
** Seminar start and end times can be modified to suit a client's schedule

OBJECTIVE, SKILLS & TARGET POPULATION

OBJECTIVE

The objective of the Stationary Battery Sizing Seminar is to provide the participants with a basic knowledge of the methods used to size stationary batteries and the battery chargers associated with them. The participant will also be provided with information that will enable her/him to develop a procurement specification for a battery system, including specification of acceptance criteria for factory testing of the battery.

SKILLS

After completing the seminar, the participant will understand the process involved to develop a battery duty cycle that will be used for battery sizing and be able to size a lead-acid or nickel-cadmium stationary battery (either vented or valve regulated) using constant current (e.g., for switchgear applications) or constant power (e.g., for uninterruptible power supply system applications) depending upon the application. Both the positive plate and

Ampere-hour methods for constant current will be discussed. The participants will understand how to determine the discharge rate factors (i.e., R_T or K_T) using the discharge data provided by the battery manufacturer. The participants will become familiar with the use of "C Rate" to describe a battery rate. Constant power sizing will be based on the Watt method of sizing. The participant will be able to determine the number of cells to be used for the battery considering limits on: minimum system voltage; maximum system voltage; battery float voltage; and battery equalize voltage. The participant will become familiar with, and understand how to select factors for design margin, temperature correction and aging. An understanding of the voltage depression factor (or float effect) for nickel-cadmium batteries that will be constant potential charged and how to determine it will be gained. The participants will learn the key factors required in a procurement specification for a stationary battery, as well as, the factory tests that should be specified, with their acceptance criteria. The participants will be able to size a battery charger to be used with a stationary battery, considering limitations on system voltage, desired recharge times and steady-state load on the charger during recharge.

TARGET POPULATION

Design, system or maintenance engineers, or others, wishing to understand how to specify and size a stationary battery and how to determine a battery charger size. The seminar provides information for both the novice and experienced battery person alike.

SEMINAR DESCRIPTION

This seminar was originally developed as an expanded version of the battery sizing module presented at the two-day Stationary Battery Workshop for those already experienced in battery sizing. It reviews sizing in more detail allowing those with less experience to obtain the skills necessary to size a stationary battery and battery charger. The Workshop has been regularly presented for more than 30 years to engineers and battery professionals of all experience levels. More than 700 companies worldwide, including battery manufacturers, utilities, telecommunications companies, banks, hospitals, securities companies, industrial companies, government agencies, armed forces, instrument companies, national laboratories, UPS manufacturers, battery maintenance companies, etc., have sent their personnel to the Workshop. The seminar is based on the information and methodologies contained in **IEEE**® Standards 485™, 1113™, 1184™ and 1189™, Section 18 of the Handbook of Electric Power Calculations, third edition (authored by M W Migliaro) and the developer's knowledge. The seminar is reviewed on a regular basis and updated as necessary to reflect the latest industry standards. Additionally, the seminar has been recognized as providing ***Continuing Education*** which has become important as more states require evidence of such seminars before renewal of an individual's electrician, professional engineer or other license or certification is granted. Depending upon the state, participants that successfully complete the Seminar may be able to satisfy all, or a portion, of those requirements.

STATIONARY BATTERY SIZING SEMINAR OUTLINE

INTRODUCTION

This portion of the seminar introduces the participants to stationary batteries and associated terminology. It defines vented and valve regulated cells and describes the characteristics of long duration, general purpose and high performance vented batteries.

ITEMS TO CONSIDER FOR AN APPLICATION

This portion of the seminar discusses the many items that must be considered when applying a stationary battery including; selection of the number of cells; physical size considerations; selection of cell type; standard ratings for stationary batteries in North America; a discussion of "C" rates; selection of vented vs. valve regulated batteries; the use of single vs. parallel battery strings; consideration of maximum and minimum system voltage, as well as, battery float and equalize voltage; capacity of the battery at the time of installation and at the end of its design life; battery short circuit current; selection of flame-retardant materials for the jar and cover; mounting and seismic considerations; and so forth. The purpose of the module is to ensure the participants understand how each of these items can affect the battery selected for an application.

CELL SELECTION AND DEVELOPMENT OF THE DUTY CYCLE

This portion of the seminar discusses the various plate types available and the advantages and/or disadvantages of each. It discusses how loads are determined and how a duty cycle is developed for the battery. There is also a discussion on random loads and special consideration for momentary loads lasting one minute or less, when a discrete sequence of loads can be established.

BATTERY SIZING

Once the duty cycle and potential cell type(s) have been identified, the process of battery sizing can begin. The use of the battery manufacturers' cell discharge data will be reviewed to determine how to find the R_T and K_T discharge factors that will be used in sizing the battery. The sizing methods discussed will be constant current and constant power. In the case of constant current sizing, both the positive plate method and Ampere-hour method will be reviewed. There will also be a discussion of the various factors that may apply to the application. These include design margin, temperature correction, aging and in the case of nickel-cadmium batteries float correction.

BATTERY CHARGER SIZING

The method used to size battery chargers for stationary batteries will be reviewed, including temperature and altitude correction. Factors to consider including the desired recharge time, maximum system voltage limitations and steady-state load will be discussed.

STATIONARY BATTERY AND BATTERY CHARGER SIZING EXCERISES

Participants will be required to perform stationary battery or battery charger sizing, including selection of discharge factors R_T and K_T, development of duty cycles, selection of sizing

factors and so forth. Participant teams will be given various case studies and will have to discuss their approach to the solution of the case study and their recommendation. The instructor will provide guidance as necessary while the participant teams work each case study.

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