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TWO-DAY* STATIONARY BATTERY SEMINAR (ESA-0101)
1.4 CEUs Awarded
OUTLINE

DAY 1

<u>TIME**</u>	<u>SUBJECT</u>
8:00 AM - 10:30 AM	Introduction & battery basics
10:30 AM - 11:30 AM	Stationary battery safety
11:30 AM - 12:30 PM	***** LUNCH *****
12:30 PM - 4:00 PM	Stationary battery installation

DAY 2

<u>TIME*</u>	<u>SUBJECT</u>
8:00 AM - 8:15 AM	Review of day 1/questions
8:15 AM - 9:00 AM	Maintenance – recommended maintenance inspections
9:00 AM – 11:30 AM	Maintenance - visual inspections
11:30 AM - 12:30 PM	***** LUNCH *****
12:30 PM – 1:30 PM	Maintenance - visual inspections (continued)
1:30 PM - 3:00 PM	Maintenance - measurements
3:00 PM – 3:30 PM	Maintenance - stationary battery discharge testing
3:30 PM - 4:30 PM	Review & Seminar Exam (optional)

* A one-day abbreviated version of this seminar is also available

** Seminar start and end times are approximate and can be modified to suit a client's schedule

STATIONARY BATTERY SEMINAR MODULE OUTLINE

STATIONARY BATTERY SEMINAR OBJECTIVE, SKILLS & TARGET POPULATION

OBJECTIVE

The objective of the Stationary Battery Seminar is to provide the participants with a basic knowledge of stationary batteries by exposing them to a vast array of battery installations of many types and sizes, in different applications. This includes a review of terminology, as well as, the types of charges which can be applied and the design considerations for installation. It also provides the participant with information on how to install, maintain and test a stationary battery. For those participants that are more experienced with stationary batteries, the seminar provides an opportunity for gaining a greater depth of knowledge of stationary battery installation and maintenance. It also provides the experienced user an opportunity to learn about battery problems that he/she may have never encountered in the field.

SKILLS

After completing the seminar, the participant will be able to recognize the types of stationary batteries available and will be familiar with the reactions that occur when the battery is discharged or charged. The participant will understand the safety procedures associated with stationary battery installations including the use of proper and safe tools and personnel protective equipment (PPE). He/she will be able to identify the industry codes and standards that discuss battery safety requirements. The participant will be able to recall the items that must be considered for proper design installation and have an understanding of how a battery should be receipt inspected and stored. The participant should be able to identify the maintenance inspections required for a battery and their frequency. He/she should be able to identify common battery problems, understand why they occur and describe the corrective actions to be taken once a problem is noted. The participant should be able to identify the types of discharge tests that may be performed on a battery and understand how frequent the tests are recommended and what criteria are used to determine when the time between tests must be decreased to ensure timely replacement of a battery. He/she should understand the criteria for battery replacement. The participant will understand the application of spill containment systems and recognize that hazard reportability requirements may apply to the battery and the type of information that may be required to be reported.

TARGET POPULATION

Maintenance and operation personnel, technicians, electricians and engineers wishing to learn about stationary batteries and their installation, maintenance and testing. The seminar provides information for both the novice and experienced battery person alike.

THE SEMINAR

The seminar is regularly updated to reflect state-of-the-art and the latest industry standards. It has been regularly presented for more than 30 years to thousands of

STATIONARY BATTERY SEMINAR MODULE OUTLINE

people 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 personnel to the seminar. The strength of the seminar is in the many photographs that enable the participants to view hundreds of installations in the seminar. Additionally, the seminar has been recognized as providing **Continuing Education** which has become important as more states require evidence of completion of educational courses before renewal of an individual's electrician, professional engineer or other license or certification is granted. Depending upon the state or province, participants that successfully complete the Seminar may be able to satisfy all, or a portion, of those requirements.

Introduction & Battery Basics

This module provides the participant with an introduction to the subject of storage batteries and in particular, industrial batteries. It identifies the stationary battery as one of the types of industrial batteries. The module discusses terminology and standard rating structures for lead-acid and nickel-cadmium stationary batteries. It also discusses the valve regulated lead-acid battery (VRLA), which many battery manufacturers have dubbed the "maintenance-free" or "sealed" battery, although the battery itself is not actually sealed and does require maintenance. It reviews the chemistry of both the lead-acid and nickel-cadmium battery. The chemistry of the valve regulated lead-acid cell is discussed relative to how it differs from the vented lead-acid cell. The module reviews the different types of positive plates that are available for lead-acid cells and the importance of the positive plate in determining battery performance and life. The different types of valve regulated lead-acid batteries are discussed, as well as, the valve regulated nickel-cadmium battery. Where appropriate, the term defined or subject under discussion is illustrated with a photograph to aid the participants' understanding. Various methods used to charge batteries, as well as, the various types of charges applied to a battery are discussed. The purpose of the module is to ensure the participants understand both terminology and "the basics" before proceeding on to the remaining topics.

Battery Safety

The module discusses battery safety and identifies standards published by **IEEE**[®], **NFPA**[®], **ICC** and **CSA** that include requirements for battery safety. A listing of US Nuclear Regulatory Guides containing requirements related to battery safety for batteries installed at Nuclear Generating Stations is provided. There is also a discussion of battery disposal/recycling, the availability and use of Safety Data Sheets (SDSs), spill containment and hazard reportability. The participant will be able to identify requirements for the use of spill containment including the requirements for hazard reportability. The information that may have to be reported and how to obtain or calculate it will be discussed.

STATIONARY BATTERY SEMINAR MODULE OUTLINE

The purpose of the module is to provide the participant with an overview of the use of batteries and industry recommendations for battery safety. Requirements for PPE including that required for arc-flash are discussed, as well as, recommended safety procedures.

Installation Design & Installation

The installation module discusses the receipt and storage of the battery, as well as, the requirements for charging the battery during storage. The steps necessary to install a battery are presented with accompanying photographs to illustrate the installation. The discussion is based upon guidance provided by battery manufacturers, **IEEE**[®] Standards 484[™], 1106[™], 1184[™] and 1187[™], and the developer's experience. The entire module is presented with numerous photographs illustrating the procedures described.

The purpose of this module is to provide the participants with the knowledge necessary to: prepare a specification for battery installation; prepare procedures for battery installation; identify requirements for battery acceptance testing; properly install a battery (or properly remove and replace cells on an existing battery, if necessary).

Maintenance Inspections

Along with proper sizing and installation, proper maintenance and testing can optimize the service life of stationary batteries. The maintenance inspection module is based upon guidance provided by battery manufacturers, **IEEE**[®] Standards 450[™], 1106[™], 1184[™] and 1188[™], NERC Standards and the developer's experience. The module describes the maintenance inspections (i.e., both visual inspections and measurements and tests) to be performed along with recommended maintenance intervals. It describes not only what to do, but how to do it. There is a discussion of internal resistance (impedance and conductance) measurements with photographs to illustrate issues identified by this measurement. Ample photographs are used to illustrate the required maintenance inspections.

The battery problem module is based almost entirely on the developer's experience and is illustrated by many photographs taken by the seminar developer, most of which illustrate a particular problem on a battery. The discussions center around battery problems that may be encountered by the participants when maintaining stationary batteries. The problems presented are comprehensive and some may never have been seen by the participants. The participant learns to identify and correct problems that affect stationary battery cells. Ample photographs are used to illustrate the problems, many of which are of cells that have been dissected to illustrate problems that may not be able to be observed in a cell. This allows the participants to better understand how the problem affects the cells and the overall performance of the battery.

The purpose of this module is to provide the participants with the knowledge necessary to: develop a maintenance plan; identify the inspections required for proper

STATIONARY BATTERY SEMINAR MODULE OUTLINE

maintenance; conduct the maintenance inspections; and identify and correct problems even if they have not observed them in a battery before.

Maintenance Corrective Actions

The maintenance corrective actions module is based upon guidance provided by battery manufacturers, **IEEE**[®] Standards 450[™], 1106[™], 1184[™] and 1188[™] and the developer's experience. The module describes the corrective actions to be taken as a result of the analysis of maintenance inspection data. The urgency of corrective actions are discussed.

The purpose of this module is to provide the participants with the knowledge necessary to: understand what corrective actions are and how they should be implemented. It provides the participant with the knowledge of the time frame in which the corrective actions need to be performed (i.e., the urgency of the corrective action) and in some instances, the requirements for additional monitoring of the battery's condition until the corrective actions are implemented.

Discharge Testing

Along with proper sizing, installation, and maintenance inspections, testing can optimize the service life of stationary batteries. The testing module is based upon guidance provided by battery manufacturers, **IEEE**[®] Standards 450[™], 1106[™], 1184[™] and 1188[™] and the developer's experience. The module describes the types of discharge tests recommended along with recommended intervals. Ample photographs are used to illustrate the required testing and test equipment used.

The purpose of this module is to provide the participants with the knowledge necessary to understand: why battery discharge testing is necessary; the types of discharge tests that may be performed; the recommended test intervals; how to evaluate the test results; and the criteria used to determine the need for battery replacement.

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