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**ONE-DAY VRLA BATTERY MAINTENANCE SEMINAR**  
**0.7 CEUs Awarded**  
**OUTLINE**

<b><u>TIME*</u></b>	<b><u>SUBJECT</u></b>
8:00 AM - 9:30 AM	Battery Basics
9:30 AM - 10:30 AM	VRLA Battery Inspection Requirements
10:30 AM - 11:30 AM	VRLA Visual Inspections
11:30 AM - 12:30 PM	***** LUNCH *****
12:30 PM - 1:30 PM	VRLA Visual Inspections (continued)
1:30 PM - 3:30 PM	VRLA Measurements & Tests
3:30 PM - 4:30 PM	VRLA Corrective Actions

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

**ONE-DAY VRLA BATTERY MAINTENANCE SEMINAR**  
**OBJECTIVE, SKILLS & TARGET POPULATION**

**OBJECTIVE**

The objective of the Valve Regulated Lead-Acid (VRLA) Battery Maintenance Seminar is to provide the participants with a basic knowledge of VRLA batteries in a variety of applications. This includes a review of terminology, as well as, a discussion of what makes the VRLA battery different from vented type batteries and the types of charges which can be applied to the batteries. It also provides the participant with information on how to maintain and test a VRLA battery. For those participants that are more experienced with stationary batteries, the seminar provides an opportunity for gaining a greater depth of knowledge of VRLA battery maintenance and testing. It also provides the experienced user an opportunity to learn about battery problems that he/she may have never encountered in the field.

# ONE-DAY VRLA BATTERY MAINTENANCE SEMINAR MODULE OUTLINE

## SKILLS

After completing the seminar, the participant will be able to recognize the two types of VRLA batteries available; will be familiar with the reactions that occur within a VRLA cell that allows it to operate without the need for periodic addition of water and what makes it different from vented lead-acid cells. 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 and understand how frequent the tests are recommended and what criteria are used to determine when the frequency of tests must be increased to ensure timely replacement of a battery. He/she should understand the criteria for battery replacement.

## TARGET POPULATION

Maintenance and operation personnel, technicians, electricians and engineers wishing to learn about VRLA 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. The strength of the seminar is in the many photographs that enable the participants to view a large number 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 such seminars 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.

## Battery Basics

This module discusses terminology and standard rating structures for lead-acid stationary batteries. It discusses the VRLA battery, 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 vented and valve regulated types, highlighting the differences between them. The module also reviews the importance of the positive plate in determining battery performance and life. The different types of valve regulated lead-acid batteries are discussed. The differences between the types of VRLA batteries are reviewed. When 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.

# ONE-DAY VRLA BATTERY MAINTENANCE SEMINAR MODULE OUTLINE

The purpose of the module is to ensure the participants understand "the basics" before proceeding on to the remaining topics.

## VRLA Battery Inspection Requirements

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**<sup>®</sup> Standard 1188<sup>™</sup>, 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. The effect of ripple current, its measurement and guidelines for limits on ripple is discussed. Ample photographs are used to illustrate the required maintenance inspections. 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 maintenance; and conduct the inspections.

## VRLA Visual Inspections

This module discusses the visual inspections that can be made on VRLA batteries. This type of battery utilizes non-transparent container so the visual inspections that can be performed are limited, but no less important than on vented cells. This portion of the seminar also discusses the visual inspections that can be made on a battery rack or cabinet, including seismic equipment, if the rack or cabinet is so equipped. There is also a short discussion on visual inspection of spill containment systems used in conjunction with VRLA batteries. The portion of this module discussing battery problems 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 during their time maintaining batteries. Basically, the participant learns to identify problems that affect VRLA cells. Ample photographs are used to illustrate the problems, a number 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: identify and correct problems even if they have not observed them in a battery before.

# ONE-DAY VRLA BATTERY MAINTENANCE SEMINAR MODULE OUTLINE

## VRLA Measurements & Tests

This module discusses the measurements and tests that can be made or performed on VRLA batteries. These measurements are important on VRLA cells since the non-transparent container do not enable visual inspection of the plates, which can aid in assessing cell health. Without the ability to perform visual inspection of the plates the measurement of cell internal resistance and evaluation of the data is an important maintenance diagnostic tool. Discharge testing for VRLA cells is discussed and is based upon guidance provided by battery manufacturers, **IEEE**<sup>®</sup> Standard 1188<sup>™</sup> and the developer's experience. 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.

## VRLA Corrective Actions

The maintenance corrective actions module is based upon guidance provided by battery manufacturers, **IEEE**<sup>®</sup> Standard 1188<sup>™</sup> 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.

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