



Battery 101 PLUS



This course is an expansion on the battery element of our Introduction to Batteries and Battery Backed Power Systems course. In this course, we will cover in more depth, the selection implementation and management of not only the Lead Acid and NiCd chemistries but will now include an expanded look at Lithium and its impact on the traditional applications.



Day One

What is a Battery?

Objective To introduce the basic principles and associated terminology of an electrochemical battery and its applications.

Lesson Outline As all batteries are electrochemical cells, we will start with a lesson in which the basic functions of the cell will be identified and the form of chemical reactions necessary to generate electricity will be explained. This will provide the basis for a more detailed explanation in subsequent lessons of the reactions involved in the specific battery technologies we will be studying.

Battery Chemistries

Objective To explain the materials used in the lead-acid, NiCd and lithium batteries and establish how their electrochemical behavior impacts how they will behave in operational use.

Lesson Outline In this lesson, the active materials and electrolyte used in the various cells will be identified and their behavior under float, charge and discharge operations will be examined in detail to establish how these cells will behave under the range of operational and environmental conditions that they may be required to operate in.

Application Battery Selection

Objective To use the information learned in the previous lesson and establish an approach to select the optimum chemistry to use for a specific project.

Lesson Outline The students will use the information about the characteristics of the different chemistries to develop a list of the environmental and operational facts they need to know in order to select the correct battery type for any application. They will then carry out a number of practical exercises in which the student will use their own lists to select a battery type for a specific application. The individual selections will be discussed and evaluated after each exercise.

Battery Sizing

Objective To determine, once the battery type is selected, the number of cells/units required to meet the application.

Lesson Outline The use of the battery manufacturers' tables and graphs to size the battery in accordance with the appropriate IEEE recommended practices will be demonstrated. Each student will then be given a specific application and they will use one of their battery selections from the previous lesson to size the battery for that application.

Battery Rack / Cabinet Selection

Objective To help the students identify the correct rack or cabinet for their previous battery selections.

Lesson Outline The selection of the correct rack or cabinet for any application is governed by a number of factors, including, but not limited to, the battery selected, the type of building, the location of the battery system in the building and the geographic location of the building. The students will be required to select the optimum rack for their specific application.

Project Review

Objective To review and discuss each student's design and product selections.

Lesson Outline As all the students will have completed a different project in this, the last lesson on day one, they will be given the opportunity to describe the application they were given and explain why they made the selections that they did.

Day Two

Why Do Batteries Fail?

Objective To identify those factors that can shorten a battery's anticipated life.

Lesson Outline There are multiple factors that occur, both environmentally and operationally, that can impact the anticipated life of a specific battery. The students will learn how to recognize those factors and why a battery's anticipated life may be at risk.

Establishing a Battery Management Plan

Objective To detail the steps required to establish a management plan that will ensure that sufficient data is collected to recognize all potential points of failure that could impact the battery's ability to support the load and that all steps necessary to mitigate that risk are taken.

Lesson Outline This lesson will explain the steps that are required to establish a management plan using the IEEE recommended practices for Vented Lead Acid Cells, Valve Regulated Lead Acid Cells, and Nickel Cadmium cells. It will include establishing the baselines and limits against which the parameter values collected during routine maintenance are evaluated. The plan should also include the actions required to correct any identified problems.

Visual Inspection

Objective To establish the value of a visual inspection as part of the Battery Management Plan.

Lesson Outline The student will be introduced to the failure mechanisms that can be visually identified but may not be reflected in the data collection as part of the management plan. They will then be given the opportunity to evaluate a series of battery pictures that illustrate the various conditions that can indicate potential failure if not corrected.

Battery Charging

Objective To introduce the importance of understanding the type of charging that the battery is being subjected to and to be aware of the variations in the types of charger being used that can affect battery life.

Lesson Outline This lesson will cover the different types of chargers that are used to maintain the battery in a fully-charged state. It will also cover the different charging regimes that the battery can be subjected to and why each battery chemistry has its own requirements. As with any manufactured product, chargers can fail and some of these failure modes that can impact battery life will be discussed.

Discharge Testing

Objective To explain how a discharge test can be used to establish the loss of capacity due to aging or to establish if an identified deviation in the collected data would impact the battery's ability to support the load.

Lesson Outline The students will be introduced to the comprehensive group of discharge test profiles that are covered in the IEEE recommended practices. Each test will be covered in detail, including any necessary tasks required before the test is carried out.

Safety and Regulatory Requirements

Objective To ensure that the students are fully aware of all the safety and other regulatory requirements that require compliance when working in the presence of a battery.

Lesson Outline This lesson will cover all aspects of battery safety in respect of both chemical and electrical hazards. The importance of understanding the requirements detailed in NFPA 70E to ensure compliance with OSHA standards will be at the core of this lesson.