



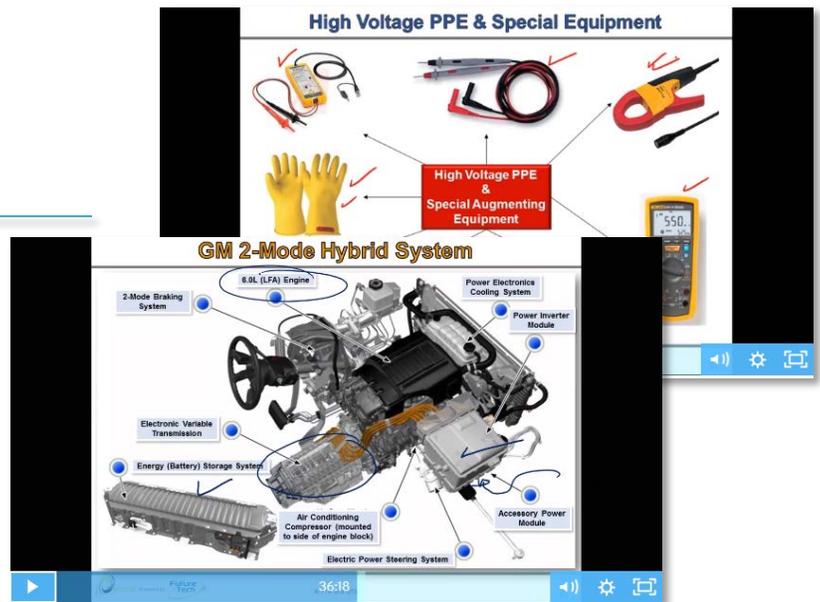
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**On-Demand Electrified Vehicle Training For  
Automotive Service Professionals and Educators**

## **Complete Training Course guide**

(Revised 4/17/2020)

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- 3-Phase Power Inverter Systems
- 3-Phase Regenerative Braking Systems
- High Voltage DC-DC Converter Systems for Hybrid and Electric Vehicles
- High Voltage Safety
- High Voltage Vehicle Safety Systems
- High Voltage Wire & Cable Systems Course
- How to Test, Analyze, and Diagnose 3-Phase Transmissions
- Hybrid/Electric Vehicle Battery Heating & Cooling
- Hybrid Electric Vehicle Electric Air Conditioning Systems
- Hybrid and Electric Vehicle "Tune Up" Maintenance
- Introduction to Hybrid Electric Vehicle Systems
- Level 1,2,3 Plug-In/Electric Vehicle On-Board Charging Systems & Chargers
- Lithium Ion Battery Family Systems
- Nickel Metal Hydride (NiMH) Hybrid Battery Systems
- Service Advisor and Manager Training for Vehicle Electrification

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# 3-Phase Power Inverter Systems (AOD3PPI008)

## 4-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

**Course Length:** Four 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

This Series on the Power Inverter is the central point of High Voltage distribution in most hybrid systems, whether the vehicle is a Toyota Prius or a Chevrolet Volt. It not only produces Alternating Current (AC) for the motor-generator systems but, it also produces Direct Current (DC) for charging the battery pack, electric air conditioning, and the DC-DC converter system. This series will concentrate on how the Power Inverter System creates AC and DC High Voltage electric power by using the IGBT (power transistor), and software controls. We will also focus on how the Power Inverter System creates AC and DC High Voltage electric power and how electrical current is regulated by control software. Analysis of 3-Phase waveforms and current regulation will be a key metric in this course. Additional diagnostic information about rotor bearings will be included. Analysis and Diagnostic strategies and tools are covered as the main points in this series. GM, Honda, Lexus, Toyota and other popular products are covered in this course.

At the conclusion of this series the technician will know the fundamentals and operation of Power Inverters as well as obtaining the diagnostic principles of the Power Inverters system. Scan Tool, Scope, Current Probes, and off-board diagnostic tools will be used heavily in this series.

### Course Outline

**Part 1:** Power Inverter Location and Component Overview

**Part 2:** Generating 3-Phase Sine and 6-Step Waveforms

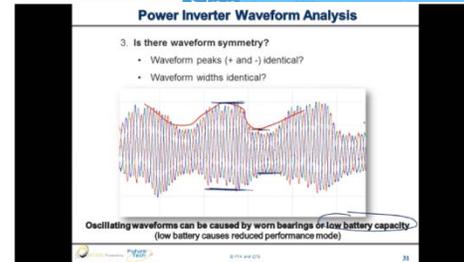
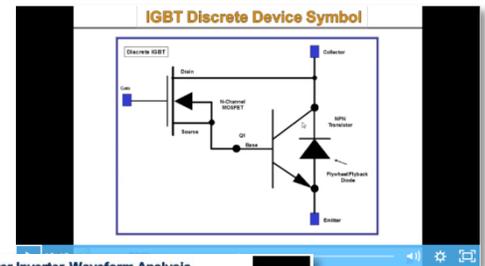
**Part 3:** 3-Phase Sine Wave Generating, Current Regulation, and Waveform Analysis

**Part 4:** Analysis and Failure Mode Diagnostics with Scopes and Scan Tool PIDs

**This course is recommended for:** Automotive Technicians

**Related Courses:** 3-Phase Regenerative Braking Systems (#AOD3PRB009)

A short preview of this course is available [here](#).



# 3-Phase Regenerative Braking Systems(AOD3PRB009)

## 3-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

**Course Length:** Three 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

Regenerative (Regen) Braking Systems are responsible for capturing vehicle energy normally lost in friction heat and transferring it to the battery pack for storage so it can be used for accelerating the vehicle. It is vital for technicians to understand this system and how it effects hybrid vehicle operation and the driving range of an all-electric vehicle and how the frequency of brake system service is affected. This series will cover how the Friction and Electric Braking systems operating modes and blended to provide a seamless braking experience for the vehicle operator. Special servicing processes for brake bleeding are also used in and need to be understood by the technician. The Toyota Prius product is featured in this course but, all the concepts and operation will apply to all other products.

At the conclusion of this series, technicians will know brake system hardware operation and controls, and electric braking operation and controls used in Regen braking. Scan Tool usage, PIDs and DTCs are also included in the series for practical application.

### Course Outline

**Part 1:** Braking System Hardware

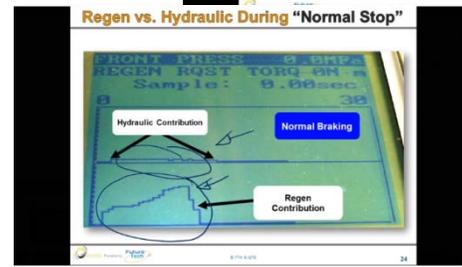
**Part 2:** Electric Braking Operation and Controls

**Part 3:** Servicing Regenerative Braking Systems and Scan Tool PIDS & DTCs

**This course is recommended for:** All Automotive Service Professionals – Automotive technicians, service advisors, service managers, and business owners (this course is beneficial for everyone due to the nature of crossover information related to maintenance and service on both friction braking and electric braking systems)

**Related Courses:** 3-Phase Power Inverter Systems (#AOD3PPI008)

A short preview of this course is available [here](#).



# High Voltage dc-dc Converter Systems (#AODDCDC007)

## 2-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

**Course Length:** Two 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

DC-DC converters replace the traditional belt-driven alternator/generator in Hybrid and Electric vehicles. These converters are High Voltage power supplies that step down battery pack voltage to 13.5 – 14.00 to charge the vehicle battery and power vehicle systems. In this series, technicians will learn about the DC-DC Converter construction, operation, and using load testers, meters, and Scopes to test its operation. Ford, GM, Honda, Lexus, Toyota and other popular products are featured in this course.

At the conclusion of this series, technicians will learn how the DC-DC converter operates, different DC-DC designs from various manufacturers, failure modes, and how to test the system for output and electrical noise.

### Course Outline

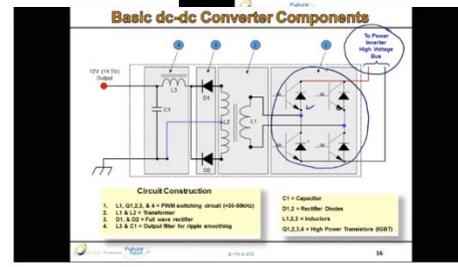
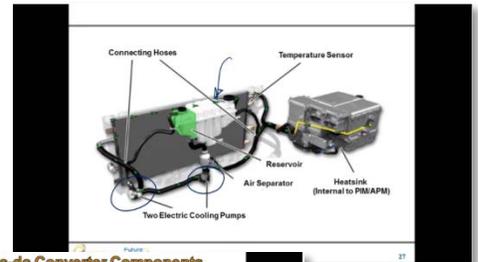
**Part 1:** dc-dc Converter Locations, Components, and Power Electronics Switching Systems

**Part 2:** dc-dc Converter Diagnostics Using Load Testers and Scopes

**This course is recommended for:** Automotive Service Advisors and Technicians

**Related Courses:** 3-Phase Regenerative Braking Systems (#AOD3PRB009)

A short preview of this course is available [here](#).



# High Voltage Safety and Personal Protective Equipment (PPE) (#AODHVS010)

## 2-Part On-Demand Training Series

### Recommended Concurrent Training:

*High Voltage Vehicle Safety Systems (#AODHVSS001)*

**Course Length:** Two 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (Additional Guides)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

High Voltage Safety & PPE is a necessary and important course to complete when planning to diagnose or repair hybrid or electric vehicles. This course will provide information on how to test High Voltage gloves, when and where to send high voltage gloves for periodic testing, and how to safely use the proper test equipment for measuring High Voltage components in live and disabled High Voltage systems. Technical information within this course will apply to any electrified vehicle.

High Voltage Safety is a primary concern when any Technician is developing, verifying, or validating a vehicle electrification system. This course will provide essential information, and the associated electrical requirements of high voltage in electrical systems and tools associated with measuring high voltage system voltage and current. The associated Personal Protection Equipment (PPE) necessary for any Technician interfacing with high voltage systems is also an integral segment of this course

At the conclusion of this course, you will know how to care for and test High Voltage gloves which, test equipment to purchase and how to use it, and how to safely make measurements on a High Voltage system.

### Course Outline

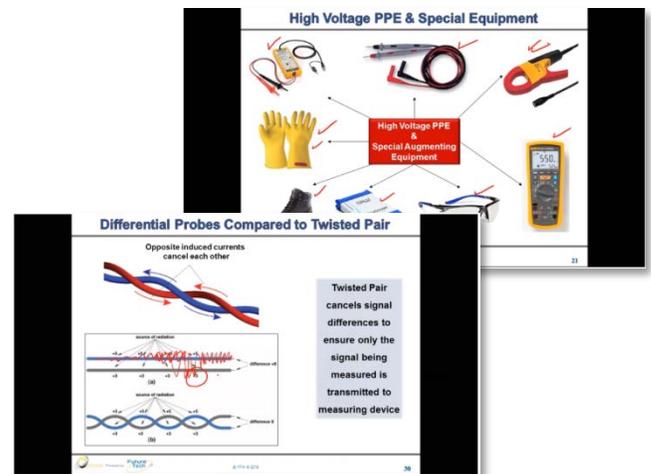
**Part 1:** Electrical Circuits and Personal Protection Equipment (PPE)

**Part 2:** Measurement Equipment and Usage

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**Related Courses:** High Voltage Vehicle Safety Systems (#AODHVSS001)

A short preview of this course is available [here](#).



# High Voltage Vehicle Safety Systems

(#AODHVVSS001)

## 4-Part On-Demand Training Series

### Recommended Concurrent Training:

High Voltage Safety and PPE (#AODHVS010)

**Course Length:** Four 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (Additional Videos)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

This course should be completed before servicing hybrid, plug-in and electric vehicles. These vehicles contain High Voltage DC and AC safety systems that are monitored by vehicle systems controllers that will maintain a safety barrier between the vehicle operator and the vehicle body/chassis to mitigate the possibility of electrical shock. This course will provide the technical information and background to know how these systems operate and effect vehicle operation and driveability. Ford, GM, Honda, Lexus, Toyota and other popular products are featured in this course.

The design and implementation of high voltage vehicle safety systems is a requirement for Technicians that work with vehicle electrification products. This course will cover the varied safety systems found on contemporary vehicle electrification products, how these systems operate, applications on current products, failure mode effects, how the vehicle is effected, and the associated diagnostics when failure occur. This course is applicable for any Technician with limited or some knowledge of high voltage vehicle electrification systems or those that need to update their current knowledge or just need a good refresher.

### Course Outline

**Part 1:** Manual Disconnect and High Voltage Interlock Systems

**Part 2:** High Voltage Isolation Fault Systems

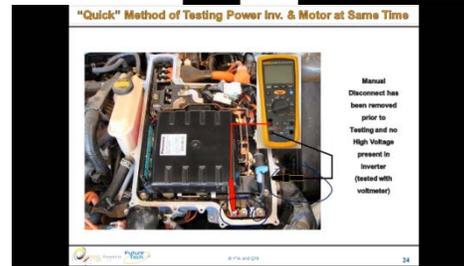
**Part 3:** Active and Passive Bus Discharge Systems

**Part 4:** Insulation Meter Testing of High Voltage Components

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**Related Courses:** Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

A short preview of this course is available [here](#).



# High Voltage Wire and Cable Systems (#AODHVWCS017)

## 1-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

**Course Length:** One 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

High Voltage wires and cables transfer power from one High Voltage device to another. In this series, students will learn about shielded cable construction, how to build shielded cables for jumper cable test leads, how to analyze and repair shielded cable, and the reasons that High Voltage system needs shielded cable. At the conclusion of this series, student will know how to analyze, repair, and build shielded cable used in High Voltage systems.

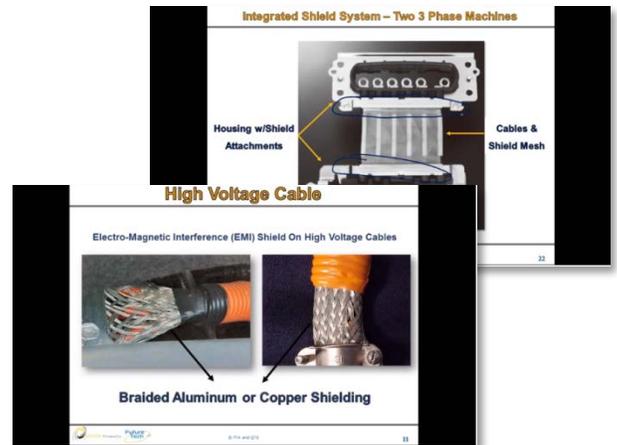
### Course Outline

**Part 1:** High Voltage Wire & Cable Systems

**This course is recommended for:** Automotive Technicians and Service Advisors

**Related Courses:** Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

A short preview of this course is available [here](#).



# How to Analyze, Test, and Diagnose 3-Phase Transmissions and Drive Units (AOD3PMGU003)

## 5-Part On-Demand Training Series

### Recommended Prerequisites:

*High Voltage Safety and PPE (#AODHVS010)*  
*High Voltage Vehicle Safety Systems (#AODHVSS001)*  
*Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)*

**Course Length:** Five 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Material (1 guide)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

Knowing how to test Permanent Magnet and Induction Motor-Generator units is one of the core analysis and diagnostics performed by a technician on a Hybrid or Electric vehicle to solve a customer complaint. This series will concentrate only on how motors and generators fail and how to test them using various testing tools and methods that are based on motor-generator testing standards. Ford, GM, Honda, Hyundai, Lexus, Toyota and other popular products are featured in this course.

At the conclusion of this series the technician will know how motor-generator units fail, how to identify the failures using visual, audio, and special testing tools. It is highly recommended that a technician complete the online training series on Permanent Magnet and Induction motor-generator units before taking this series.

### Course Outline

**Part 1:** How Electric Motors and Generators Fail (Failure Modes)

**Part 2:** Testing Methods for Electric Motors and Generators

**Part 3:** Testing Methods for Electric Motors and Generators (Continued)

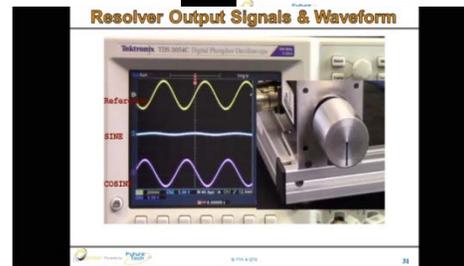
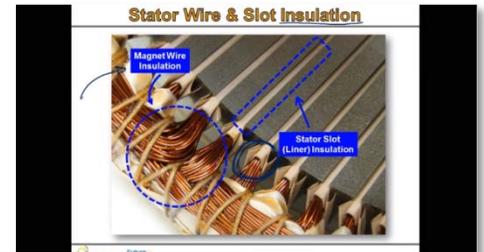
**Part 4:** Testing Methods for Electric Motors and Generators (Continued)

**Part 5:** Encoder/Resolver Speed & Position Sensor Scan Tool and Scope Diagnostics

**This course is recommended for:** Automotive Technicians and Automotive Service Business Owners

**Related Courses:** 3-Phase Regenerative Braking Systems (#AOD3PRB009)  
High Voltage Wire & Cable Systems (#AOD3HVWCS017)

A short preview of this course is available [here](#).



# Hybrid/Electric Vehicle Battery Heating & Cooling (#AODHACS014)

## 5-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

**Course Length:** Five 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

Battery Pack Heating and Cooling Systems have become the focal point of the Hybrid, Plug-In, and Electric Vehicle industry, due to their integration with the High Voltage system. Understanding the operation of these systems and how battery pack cooling and heating systems failures effect the operation of the powertrain and accessory circuits are a must for any technician that, is or will be, diagnosing and repair them. Scan Tool data will be used to support the presentations. GM, Honda, Hyundai, Nissan, Tesla, Toyota electric and hybrid vehicle products are featured in this course.

At the conclusion of this series, technicians will know how cooling/heating systems operate, effect vehicle performance and fuel economy, and diagnostic strategies for repairing them to correct failures.

### Course Outline

**Part 1:** Hybrid, Plug-In, and Electric Vehicle battery Systems & Internal Components

**Part 2:** Battery Pack Cooling Systems & Controls

**Part 3:** Air Battery Pack Heating Systems & Introduction to Controls

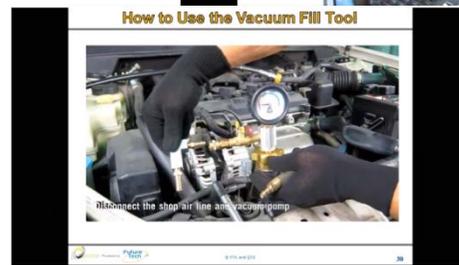
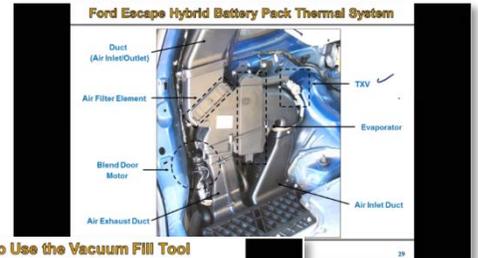
**Part 4:** Heating & Cooling Effects on Vehicle Performance

**Part 5:** HEV, PHEV, and BEV Battery Systems Failure Modes, DTCs, and PIDS

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians), with a special emphasis on air conditioning specialists

**Related Courses:** Hybrid Electric Vehicle Electric Air Conditioning Systems (#AODVEAC012) and NiMH Hybrid Battery Systems (#AODNIMH005)

A short preview of this course is available [here](#).



# Hybrid Electric Vehicle Electric Air Conditioning Systems (#AODVEAC012)

## 3-Part On-Demand Training Series

### Recommended Prerequisites:

*High Voltage Safety and PPE (#AODHVS010)*  
*High Voltage Vehicle Safety Systems (#AODHVSS001)*  
*Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)*

**Course Length:** Three 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (Guide and Worksheet)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

Electric Air Conditioning (A/C) systems used in hybrid, plug-in, and electric vehicles are unlike the belt-driven systems used in traditional vehicles. The Stop-Start or all electric operation of a vehicle requires an air conditioning system that operates and cools the cabin (and in some cases the battery pack) regardless of vehicle mode. This series will provide the technician information and practical applications for understanding systems operation, diagnosis, using the correct system oil, and repair of vehicles using a High Voltage A/C system. GM, Honda, Lexus, Toyota and other popular products featured in this course.

At the conclusion of this course, technicians will have a firm understanding of these systems, how A/C systems can be used to cool battery packs, how to select the correct compressor oils, and testing compressors using Scan Tools and special tools.

### Course Outline

**Part 1:** 3-Phase Electric Compressor System Components and Operation

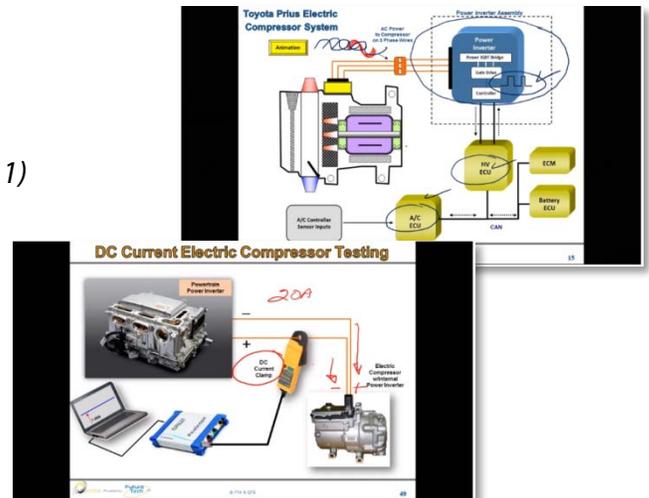
**Part 2:** Special Use of Air Conditioning Systems – Cabin and Battery Pack Cooling

**Part 3:** Air Conditioning Systems Special Service Topics

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians), with a special emphasis on air conditioning specialists

**Related Courses:** Hybrid/Electric Vehicle Battery Heating and Cooling (#AODHACS014)

A short preview of this course is available [here](#).



# Hybrid/Electric Vehicle Tune Up Maintenance (#AODHEVTU004)

## 3-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

**Course Length:** Three 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (1 worksheet and guide)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

Traditional vehicles need maintenance and hybrid and electric vehicles also need even more maintenance care, due to the different operating modes and additional High Voltage systems. The hybrid vehicle contains more cooling systems, an electric drive or transmission, and need special care of the High Voltage system to ensure optimal operation. This course will focus on how to maintain the engine and High Voltage systems on hybrid vehicles and how to educate the customer and make them aware of how their vehicle needs to be maintained. Ford, Honda, Lexus, Toyota hybrid electric vehicle products are featured in this course.

At the conclusion of this course, technicians will know which hybrid systems need special maintenance and how to perform this maintenance service. Scan Tools and PID data will be used to identify system operation and help the technician determine what systems need additional maintenance care.

### Course Outline

**Part 1:** Battery Pack, Power Electronics, and Transmission Testing/Maintenance

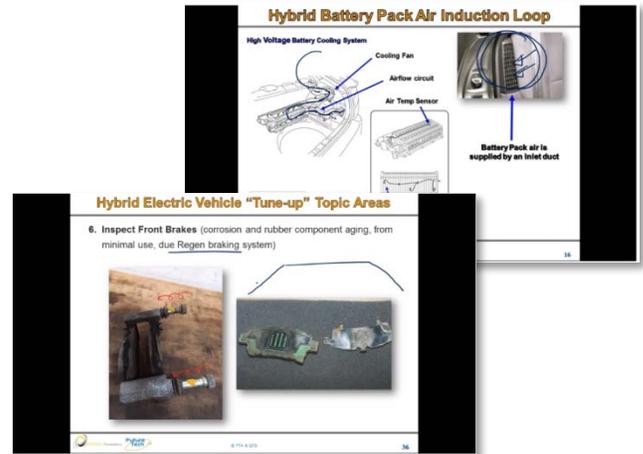
**Part 2:** Battery Pack Stress Testing: Scan Tool PIDs and DTCs

**Part 3:** Special Maintenance Topics for Hybrid Vehicles

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**Related Courses:** Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

**A short preview of this course is available [here](#).**



# Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

## 2-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

**Course Length:** Two 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

Hybrid Electric Vehicle (HEV) models currently populating the vehicle electrification landscape indicate their dominance in the market. Although electric, plug-in, and fuel cell vehicles are making inroads in the market, the HEV stands as the market leader in adoption, and manufacturers have no plans on diminishing HEV production.

HEV powertrain operation is totally different from the traditional vehicle. It is essential to understand the various operating modes and how failure modes in the hybrid system affect its operation. Scan tool data, animations, and detailed graphics are used for teaching how these systems operate and how different diagnostic approaches are required.

This course will provide technicians and other automotive professionals that need a thorough and detailed introduction to HEV technology the opportunity to learn this technology and the focus on how systems are designed, rationale for the design, powerflow, CAN PIDs, and more. Most of the fundamental information can be applied to electric, plug-in, extended range, and fuel cell systems.

At the conclusion of this course, participants will have a firm knowledge of hybrid system operation based on the different powertrain configurations and how Scan Tool data and diagnostics differ from traditional vehicles.

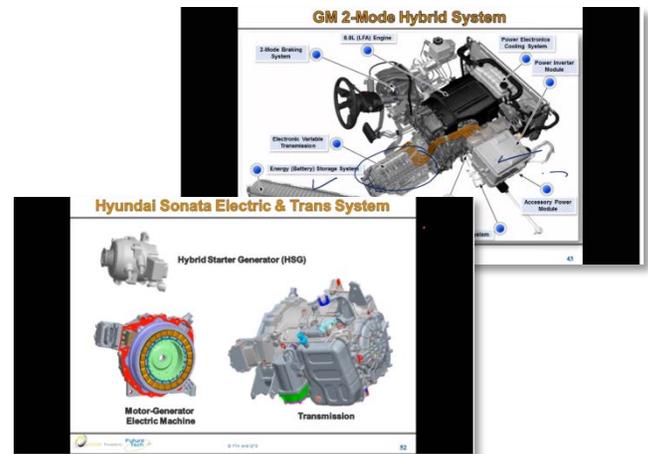
### Course Outline

**Part 1:** Hybrid Electric Vehicle System Components & Locations

**Part 2:** High Voltage Powertrain Operation

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**A short preview of this course is available [here](#).**



# Level 1,2,3 Plug-In/EV On-Board Charging Systems & Chargers (#AODL123015)

## 3-Part On-Demand Training Series

### Recommended Prerequisites:

*High Voltage Safety and PPE (#AODHVS010)*  
*High Voltage Vehicle Safety Systems (#AODHVSS001)*  
*Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)*

**Course Length:** Three 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (1 guide)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

Plug-In and Electric Vehicles are quickly becoming a larger part of the vehicle market due to their all electric operation. These vehicles need access to charging systems to recharge the large battery packs in a short period. This series will cover the 3 Levels of charging stations and the associated vehicle on-board charging systems. It is critical that technicians understand the 3 Levels of charging stations and the vehicle on-board chargers to gain an understanding of charging systems diagnostics and repair. At the conclusion of this series, the technician will know all 3 Levels of charging stations, on-board chargers, how charging station and on-board charger power is controlled and the associated diagnostics.

### Course Outline

**Part 1:** Vehicle On-Board Charging Systems

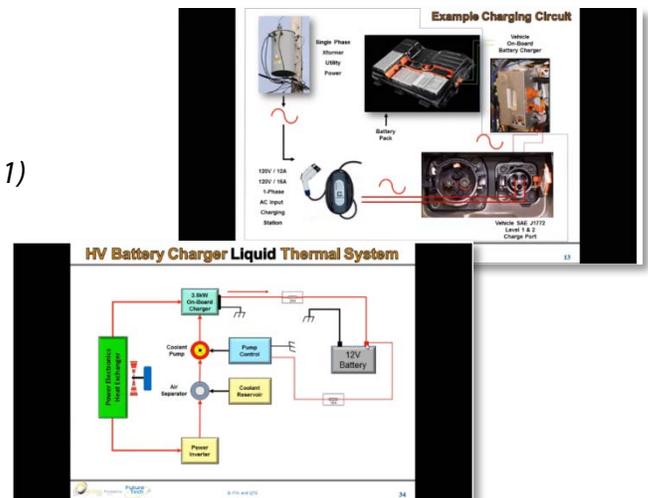
**Part 2:** On-Board Charging Systems: Volt, C-Max, Leaf, and Prius Plug-In

**Part 3:** Level 1,2, and 3 Charging Systems

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**Related Courses:** Lithium Ion Family Battery Systems (#AODLION006)

A short preview of this course is available [here](#).



# Lithium Ion Family Battery Systems (#AODLION006)

## 5-Part On-Demand Training Series

### Recommended Prerequisites:

High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

**Course Length:** Five 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (1 worksheet)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)

### Course Overview

The Lithium Ion family of technologies are the primary technology for plug-in and electric vehicles but, it is also being found in hybrid products. The many different Lithium technologies will force technicians to become familiar with it so they will understand how it impacts diagnostics and repair. Each family can have a different discharging voltage characteristic which effects vehicle and Scan Tool diagnostics. This series will provide the technician with the necessary information on all of the Lithium technologies, cell balancing systems, failure modes, diagnostics, and how these battery packs can be repaired instead of replaced.

Technicians with limited or some knowledge or experience with high voltage Lithium battery pack education will find this course of immense benefit. There are also areas within the course that could benefit more seasoned battery pack professionals. Whether a Technician is involved with HEV, PHEV, BEV, EREV or FCEV products, this course will provide information on Lithium cell operation, Battery Management System operation, battery pack hardware systems, battery cell failure modes, cell/module testing methods, battery stress testing, and how this differs from NiMH Systems. At the conclusion of this course, the technician will be able to identify the various Lithium formats, aspects cell aging, rebuilding concepts, and understand how to use Scan Tool PIDs to help analyze, diagnose and repair the battery pack.

### Course Outline

**Part 1:** Lithium Ion Battery Families: Cell Construction and Operation

**Part 2:** Lithium Product Systems

**Part 3:** Vehicle Performance Changes Due to Lithium Aging and Cell Balancing

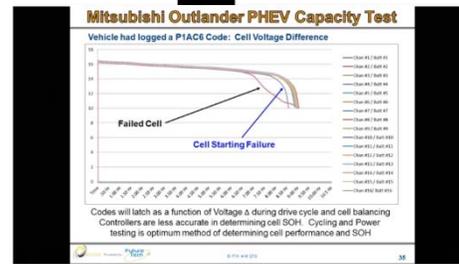
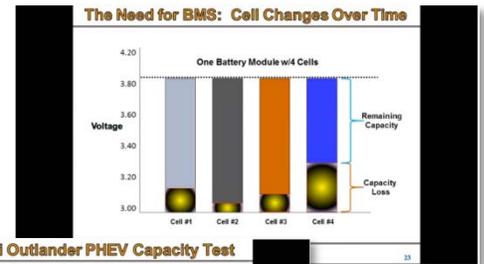
**Part 4:** Failure Modes and What Causes Cell Aging or Loss of Capacity

**Part 5:** How to Test/Diagnose Plug-In and EV Battery Packs Using the Scan Tool

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**Related Courses:** Hybrid/Electric Vehicle Battery Heating & Cooling (#AODHACS014) and Level 1, 2, 3 Plug-In/Electric Vehicle Onboard Charging Systems & Charging (#AODL123015)

A short preview of this course is available [here](#).



# Nickel Metal Hydride (NiMH) Hybrid Battery Systems (#AODNIMH005)

## 5-Part On-Demand Training Series

### Recommended Prerequisites:

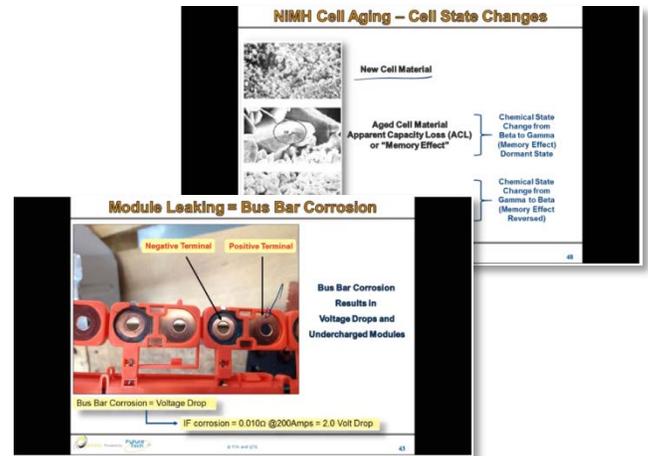
High Voltage Safety and PPE (#AODHVS010)

High Voltage Vehicle Safety Systems (#AODHVSS001)

**Course Length:** Five 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (1 worksheet and guide)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)



### Course Overview

NiMH battery systems continue to be used in Hybrid Electric Vehicle (HEV) applications and provide an excellent foundation in high voltage battery pack systems. This course will include NiMH battery cell operation, cell/module failure modes, diagnostic testing methods, battery hardware components, battery stress testing techniques – and how some of these areas differ from Lithium systems. This course provides automotive service professionals with limited or some experiences in high voltage battery pack systems an excellent foundation to learn these battery pack systems and use this information as platform to learn high voltage Lithium battery pack systems. There are also areas within the course that could benefit more seasoned battery pack professionals.

This course will concentrate on the NiMH technology, how it performs as it ages, how it can effect vehicle performance and fuel economy, and how to test it by using a Scan Tool. At the conclusion of this series, the technician will be able to identify the condition of a battery pack, servicing instead of replacing it, and using specific testing methods outlined in this course.

### Course Outline

**Part 1:** NiMH Batteries: Cell Construction and Operation

**Part 2:** NiMH Product Systems: Ford, GM, Honda, Lexus, Nissan, and Toyota Batteries

**Part 3:** NiMH: Vehicle Performance Changes Due to NiMH Aging

**Part 4:** Failure Modes and What Causes Cell Aging or Loss of Capacity

**Part 5:** How to Test and Diagnose NiMH Hybrid Battery Packs Using the Scan Tool

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**Related Courses:** Hybrid/Electric Vehicle Battery Heating & Cooling (#AODHACS014) and Introduction to Hybrid Electric Vehicle Systems (#AODIHEV011)

A short preview of this course is available [here](#).



# Service Advisor and Manager Training for Vehicle Electrification (#AODSAMT002)

## 4-Part On-Demand Training Series

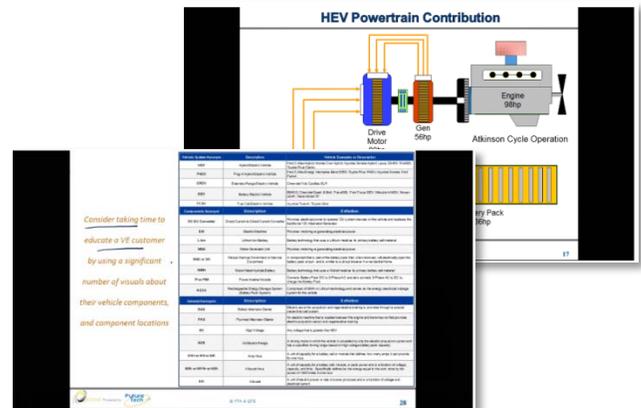
### Recommended Prerequisites:

All Available Access OnDemand Training Courses

**Course Length:** Four 1-hour Video Modules

**Instructor:** [Dr. Mark Quarto](#)

- Digital Course Handbooks Included (1 per module)
- Supplemental Materials (1 guide)
- Learning Assessments (1 quiz per module)
- Certificate of Completion (1 per completed quiz)



### Course Overview

This course is a must for the Service Advisor or Service Manager, who serve as the critical and initial point of contact with new customers that own advanced technology product categories such as Hybrid Electric Vehicles (HEV), Plug-In Hybrid Electric Vehicles (PHEV), Extended Range Electric Vehicles (EREV), and Battery Electric Vehicles (BEV).

Customers that own these vehicles are often more “tech-savvy” and in order to gain their trust, and their business, an Adviser or Manager must be able to confidently advise them about maintenance and other services their technology-drive vehicle requires. Specifically, the advanced technology customer is searching for competent advisement and services. Ford, GM, Honda, Lexus, Nissan, Toyota electric and hybrid vehicle products are featured in this course.

This course provides the Service Advisor or Manager with necessary technical information and new skills so they can guide these customers in the care of their advanced technology vehicles. Additionally, this course will help participants become conversationally versed in the “lingo” of these technologies, gain the trust and confidence of the owner, and accurately convey the customer problem(s) to the technician who will diagnose and service the vehicle.

### Course Outline

**Part 1:** Product-Specific Hybrid & Electric Vehicle Systems

**Part 2:** How a Traditional Vehicle Differs from a Hybrid or Electric Vehicle

**Part 3:** Top Failure Modes and Customer Complaints of Hybrid and Electric Vehicles

**Part 4:** How to Communicate with Customers About Their Hybrid or Electric Vehicle

**This course is recommended for:** All Automotive Service Professionals (Business owners, service managers, service advisors, and technicians)

**Related Courses:** All available Access OnDemand training courses

A short preview of this course is available [here](#).



# Suggested Learning Path



**Take the on-demand courses in the following order to maximize your understanding and retention of each topic.**

1. High Voltage Safety and PPE – 2-Part Series
2. High Voltage Vehicle Safety Systems - 4-Part Series
3. Introduction to Hybrid Electric Vehicle Systems Operation – 2-Part Series
4. Service Advisor & Manager Training for Hybrid and Electric Vehicles – 4-Part Series
5. Hybrid Electric Vehicle “Tune-Up” Maintenance – 3-Part Series
6. Nickel Metal Hydride (NiMH) Hybrid Battery Systems – 5-Part Series
7. Lithium Ion Battery Family Systems – 5-Part Series
8. How to Analyze, Test and Diagnose 3-Phase Hybrid & Electric Vehicle Transmissions & Drive Units – 5-Part Series
9. 3-Phase Regenerative Braking Systems – 3-Part Series
10. Hybrid and Electric Vehicle Air Conditioning Systems – 3-Part Series
11. Hybrid and Electric Vehicle Battery Heating/Cooling Systems – 5-Part Series
12. 3-Phase Power Inverter Systems for Hybrid and Electric Vehicles – 4-Part Series
13. High Voltage dc-dc Converter Systems for Hybrid and Electric Vehicles – 2-Part Series
14. Level 1, 2, and 3 Plug-In and Electric Vehicle Onboard Charging Systems and Chargers – 3-Part Series
15. High Voltage Wire & Cable Systems – 1-Part Course



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Email: [info@futuretechauto.com](mailto:info@futuretechauto.com)

Phone: 360.207.7770