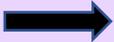


 High Voltage Safety & PPE 2-Part Series	
Course 1	Part 1 Electrical Circuits and Personal Protection Equipment (PPE)
	Part 2 Measurement Equipment and Usage
	<u>Series Abstract:</u> High Voltage Safety is the primary course that every technician desiring to diagnose or repair hybrid or electric vehicles will need to complete. This course will provide technicians 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. This course may also be a requirement of employers as a condition of employment for the technician and for insurance liability coverage purposes. At the conclusion of this course, technicians 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.

 High Voltage Vehicle Safety Systems 4-Part Series	
Course 2	Part 1 Manual Disconnect and High Voltage Interlock Systems
	Part 2 High Voltage Isolation Fault Systems o DC Systems o AC Systems
	Part 3 Active and Passive Bus Discharge Systems
	Part 4 Insulation Meter Testing of High Voltage Components to Locate Isolation Faults and Scan Tool PIDs and DTCs
	<u>Series Abstract:</u> High Voltage Safety is the primary course that every technician desiring to diagnose or repair hybrid or electric vehicles will need to complete. This course will provide technicians 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. This course may also be a requirement of employers as a condition of employment for the technician and for insurance liability coverage purposes. At the conclusion of this course, technicians 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.

 Introduction to Hybrid Electric Vehicle Systems Operation 2-Part Series	
Course 3	Part 1 Hybrid Electric Vehicle System Components & Locations <ul style="list-style-type: none"> o Hybrid System Architectures and Powertrain Configurations o Hybrid Power Model o Hybrid System Modes of Operation
	Part 2 High Voltage Powertrain Operation <ul style="list-style-type: none"> o Motor-Generator Operation With and Without Planetary Gear Sets <ul style="list-style-type: none"> ▫ Hyundai Sonata Hybrid ▫ Toyota Prius
	<u>Series Abstract:</u> Hybrid Electric Vehicle powertrain operation is totally different from the traditional vehicle. It is essential that technicians understand the various operating modes and how failure modes in the hybrid system effect its operation. Scan Tool data, animations, and detailed graphics are used to teach the technician how these systems operate and how different diagnostic approaches are required. 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.

 Service Advisor & Manager Training for Hybrid and Electric Vehicles 4-Part Series	
Course 4	Part 1 Hybrid & Electric Vehicle Systems for BMW, GM, Ford, GM, Honda, Hyundai, Lexus, Nissan, & Lexus Systems: <ul style="list-style-type: none"> o Components, Component Locations, Definitions, Acronyms, and Understanding Instrumentation Displays
	Part 2 How a Traditional Vehicle Differs from the Hybrid and Electric Vehicle: Powertrain System Operation for Service Advisors and Managers: You Need to Know More Than Your Customers
	Part 3 Top Failure Modes & Customer Complaints of Hybrid & Electric Vehicle Systems
	Part 4 How to Communicate with Customers to Help Them Understand Their Hybrid & Electric Vehicle
	<u>Series Abstract:</u> Hybrid and Electric vehicles continue to quickly penetrate the aftermarket, whether the vehicle is within or out of warranty. Customers are constantly looking for qualified service shops to maintain and repair their vehicles rather than continually returning their vehicle to the dealer for servicing. This course is designed to train Service Advisors and Managers on how to confidently communicate to the tech-savvy vehicle owner to advise and sell shop services. This series will inform the Service Advisor and Manager how hybrid vehicles operate, age, and fail and how to communicate this information to the customer to gain trust and increase value. At the conclusion of this series, the Service Advisor and Manager will have the information and acquired skills to confidently communicate with hybrid and electric vehicle customers to earn their service business

 Hybrid Electric Vehicle “Tune-Up” Maintenance 3-Part Series	
Course 5	Part 1 Battery Pack System, Power Electronics Cooling System Maintenance & Testing, and Electric Transmission Maintenance
	Part 2 Battery Pack Stress Testing: Scan Tool PIDs and DTCs
	Part 3 Special Maintenance Topics for Hybrid Vehicles: <ul style="list-style-type: none"> o The 12 Volt Battery Importance to Controller Performance o MAF and Throttle Body o Front & Rear Brake Inspection o Battery Pack Filters o Battery Service Disconnect Cleaning o Battery Bus Bar Cleaning
	Series Abstract: 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. 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.

 Nickel Metal Hydride (NiMH) Hybrid Battery Systems Series 5-Part Series	
Course 6	Part 1 NiMH Batteries: Cell Construction and Operation
	Part 2 NiMH Product Systems: Ford, GM, Honda, Lexus, Nissan, and Toyota Battery Pack Systems
	Part 3 NiMH: Vehicle Performance Changes Due to NiMH Aging
	Part 4 NiMH Cylindrical and Prismatic Modules: 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 - Battery Pack Stress Testing: Scan Tool PIDs and DTCs
Series Abstract: This course series is a MUST for any technician that is servicing hybrid vehicles. NiMH battery systems continue primary battery technology in hybrid vehicles and have been since the 2000 model year. If a technician doesn't know the fundamentals of NiMH operation it is impossible for them to provide the customer a solid diagnosis or repair. 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.	

 Lithium Ion Battery Family Systems 5-Part Series	
Course 7	Part 1 Lithium Ion Battery Families: Cell Construction and Operation
	Part 2 Lithium Product Systems: o Hybrid Systems: Ford, GM, Honda, Hyundai, Mercedes-Benz, Battery Pack Systems o Plug-In Vehicle Systems: Ford, GM, Toyota Battery Pack Systems o Electric Vehicle Systems: BMW, Ford, GM, Nissan, Tesla
	Part 3 Lithium Battery: Vehicle Performance Changes Due to Lithium Aging and Cell Balancing
	Part 4 Lithium Cylindrical and Pouch Modules: Failure Modes and What Causes Cell Aging or Loss of Capacity
	Part 5 How to Test and Diagnose Plug-In and Electric Vehicle Battery Packs Using the Scan Tool - Battery Pack Stress Testing: Scan Tool PIDs and DTCs
	<u>Series Abstract:</u> 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. 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.

 How to Analyze, Test & Diagnose 3-Phase Hybrid & Electric Vehicle Transmissions & Drive Units 5-Part Series	
Course 8	Part 1 How do Electric Motors and Generators Fail and Failure Modes
	Part 2 Testing Methods for Electric Motors and Generators Part 1 o Insulation Meter Resistance Testing o Milliohm Resistance Testing
	Part 3 Testing Methods for Electric Motors and Generators Part 2 o Waveform Testing Using a Scope
	Part 4 Testing Methods for Electric Motors and Generators Part 3 o Special Motor-Generator Testing Tools o Scan Tool PIDs and DTCs
	Part 5 Encoder and Resolver Speed and Position Sensor Scan Tool and Scope Diagnostics
	<u>Series Abstract:</u> 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 test various testing tools and methods that are based on motor-generator testing standards. 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.

 3-Phase Regenerative Braking Systems 3-Part Series	
Course 9	Part 1 Braking System Hardware: Actuators, Stroke Sensors, Emulator/Simulators, and Controllers
	Part 2 Electric Braking Operation and Controls
	Part 3 Servicing Regen Braking Systems and Scan Tool PIDs and DTCs
	<p>Series Abstract:</p> <p>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 effected. 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. 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.</p>

 Hybrid and Electric Vehicle Electric Air Conditioning Systems 3-Part Series	
Course 10	Part 1 3-Phase Electric Compressor System Components and Operation
	Part 2 Special Use of Air Conditioning Systems: Cabin and Battery Pack Cooling
	<p>Part 3</p> <p>Air Conditioning System Special Service Topics</p> <ul style="list-style-type: none"> o Oils and Isolation Fault Issues o Compressor Current Testing Using Current Probes and Scope o Scan Tool PIDs and DTCs
	<p>Series Abstract:</p> <p>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. 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.</p>

 Course 11	Hybrid and Electric Vehicle Battery and Heating/Cooling Systems 5-Part Series
	Part 1 Hybrid, Plug-In, and Electric Vehicle Battery Systems and Internal Components
	Part 2 Battery Pack Cooling Systems and Controls Diagnostics and Failure Modes: Passive Air, Air Conditioned, and Liquid
	Part 3 Battery Pack Heating Systems and Controls
	Part 4 How Battery Pack Heating/Cooling Systems Effect Vehicle Performance: Diagnostics & Failure Modes
	Part 5 Scan Tool PIDs and DTCs
	<p>Series Abstract:</p> <p>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/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. 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.</p>

 Course 12	3-Phase Power Inverter Systems for Hybrid and Electric Vehicles 4-Part Series
	Part 1 Power Inverter Locations, Internal Components, 6-Pack Motor Drives, and IGBT Power Transistor Operation
	Part 2 Generating 3-Phase Sine and 6-Step Waveforms
	Part 3 3-Phase Sine Wave Generating, Current Regulation and Waveform Analysis
	Part 4 3-Phase Waveform Analysis, Bearing, and Power Inverter Failure Mode Diagnostics with Scopes and Scan Tool PIDs

Course 13	High Voltage DC-DC Converter Systems for Hybrid and Electric Vehicles 2-Part Series
	Part 1 DC-DC Converter Locations, Internal Components, Power Electronics Switching Systems
	Part 2 DC-DC Converter Diagnostics Using Load Testers and Scopes
	<p>Series Abstract:</p> <p>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. 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.</p>

Course 14	Level 1, 2, and 3 Plug-In and Electric Vehicle On-Board Charging Systems and Chargers 3-Part Series
	Part 1 Vehicle On-Board Charging Systems
	Part 2 Chevrolet Volt, Ford C-Max Energy, Nissan Leaf, and Toyota Prius On-Board Chargers
	Part 3 <p>Level 1, 2, & 3 Charging Station Systems</p> <ul style="list-style-type: none"> o Level 1: 120Vac Charging Stations o Level 2: 240Vac Charging Stations o Level 3: DC Fast Charging Systems
	<p>Series Abstract:</p> <p>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.</p>

Course 15	High Voltage Wire and Cable Systems
	1 Part High Voltage Wire and Cable Systems Construction, Operation, Installation, and Repair When Damaged
	<p>Series Abstract:</p> <p>High Voltage wires and cables transfer power from one High Voltage device to another. In this series, technicians 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, technicians will know how to analyze, repair, and build shielded cable used in High Voltage systems.</p>