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Electrified Propulsion Vehicles
High-voltage Electrical Safety Standards

ASE Announces New EV Standards And An EV Testing And Certification Program

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NATIONAL AUTOMOBILE DEALERS ASSOCIATION

Electrified Propulsion Vehicles
High-voltage Electrical Safety Standards

ASE Announces New EV Standards And An EV Testing And Certification Program

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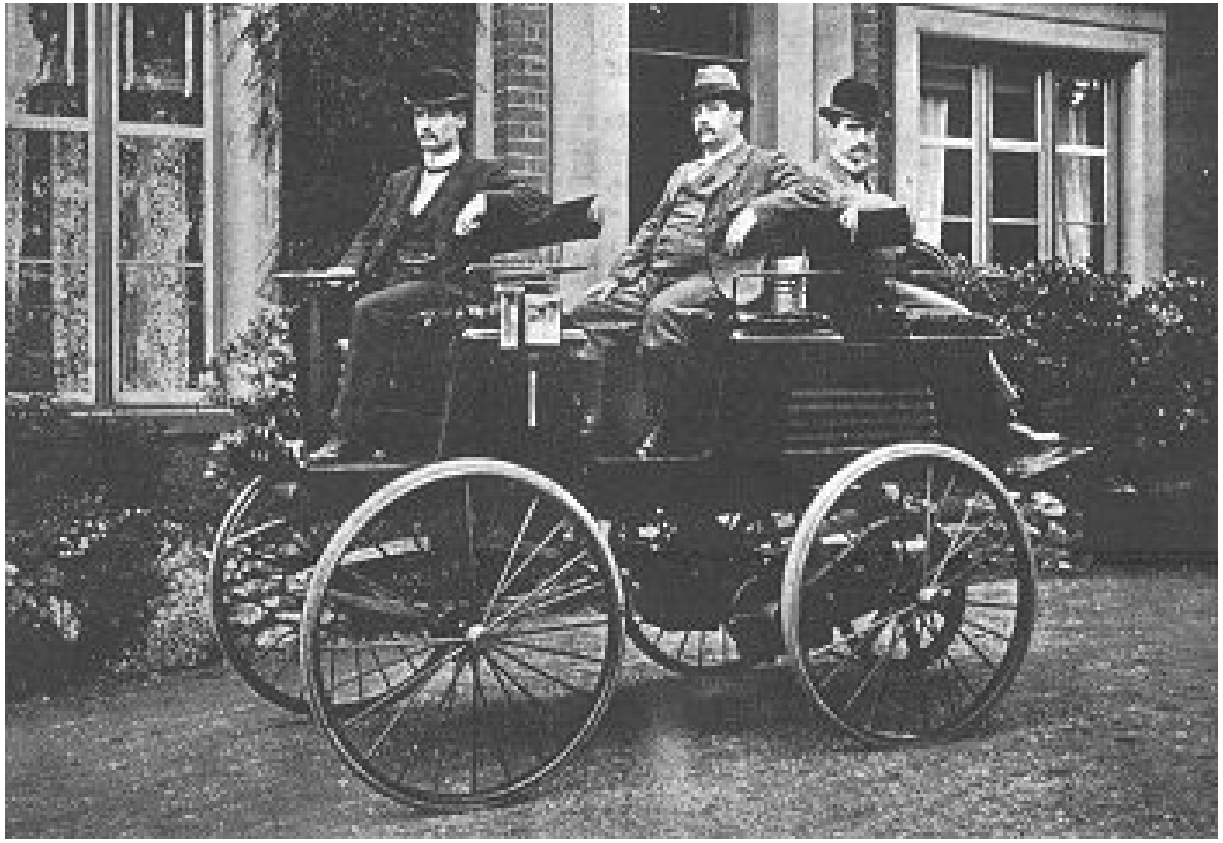
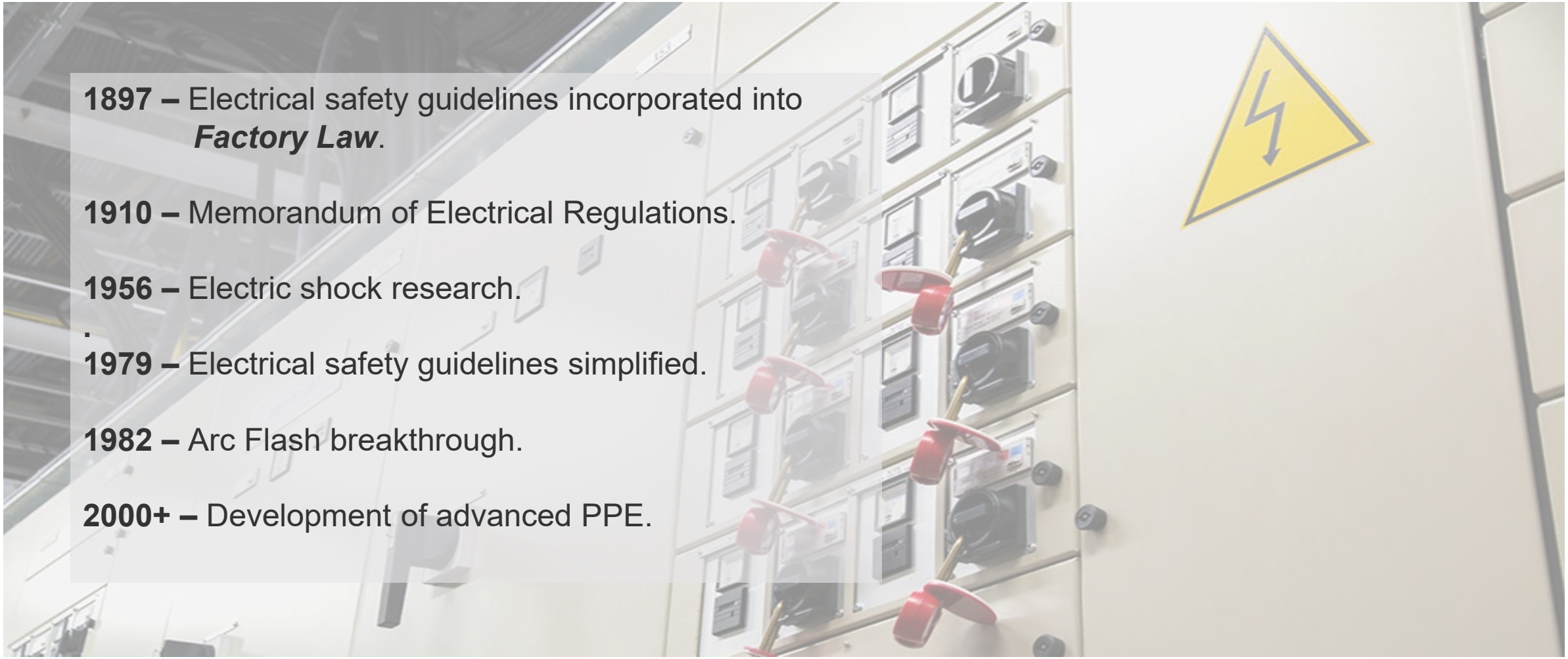
Electrified Vehicles Are Not New



Images courtesy of Wikimedia Commons and Iowa History Journal.

William Morrison in 1890.

Electrical Safety Guidelines Are Not New



1897 – Electrical safety guidelines incorporated into ***Factory Law***.

1910 – Memorandum of Electrical Regulations.

1956 – Electric shock research.

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1979 – Electrical safety guidelines simplified.

1982 – Arc Flash breakthrough.

2000+ – Development of advanced PPE.

Existing Standards

ASE Electrified Propulsion Vehicles (xEV)
High-Voltage Electrical Safety Standards

Safety-related Work Practices

OSHA is “What we have to do”

NFPA 70E is “How we accomplish what OSHA requires”.

As the work environment and the type of job become more hazardous, the need for protection increases.

OSHA and NFPA-70E addresses:

- Safety-related work practices
- Maintenance of safety equipment
- Safety requirements for special equipment
- Safety related installation requirements

OSHA

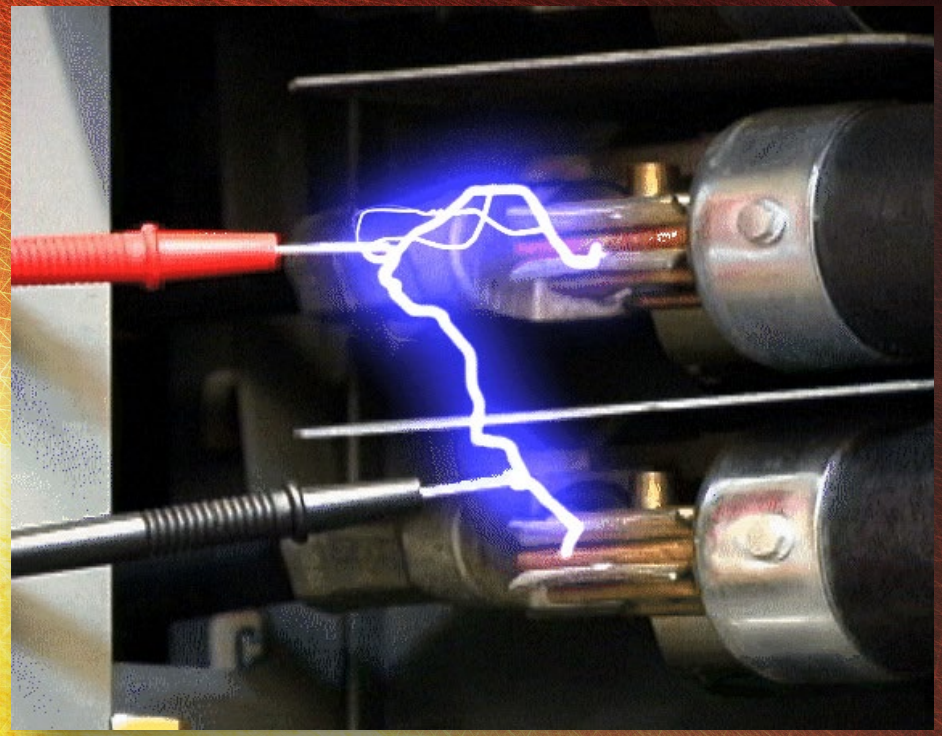
NFPA® 70E

Risks From Electrocution And Shock Hazards

Current level	Probable effect on the human body
1mA	**Slight tingling sensation.** Still dangerous under certain conditions.
5 mA	**Slight shock felt; not painful but disturbing.** Average individual can let go. However, strong involuntary reactions to shocks in this range may lead to injuries.
6–16 mA	**Painful shock, begin to lose muscular control.** Possible fall danger. Referred to as the freezing current or "let-go" range.
17–99 mA	**Extreme pain, respiratory arrest, severe muscular contractions.** Individual cannot let go. Death is possible.
100–2000 mA	**Ventricular fibrillation (uneven, uncoordinated pumping of the heart.)** Muscular contraction and nerve damage begins to occur. Death is likely.
Over 2000 mA	**Cardiac Arrest, internal organ damage, and severe burns.** Death is probable.

Risks From An Arc Flash

- Current passes through the air.
- Ionized air (plasma) is a good conductor.
- Once an arc begins, it feeds off any matter in its path and vaporizes it.
- Duration is under one second.



Personal Protective Equipment

PPE – Personal Protective Equipment

The PPE type and category is used to determine the necessary arc rating of a garment worn during a given job task.

PPE Category	Required Minimum Arc Rating of PPE	Typical Layers
1	4 Cal/cm²	1
2	8 Cal/cm²	1 or 2
3	25 Cal/cm²	2 or 3
4	40 Cal/cm²	3 or more

The higher the electrical environment, the stronger the personal protective equipment must be to withstand an arc-flash incident.

Images courtesy of Salisbury

EV High-voltage Electrical Safety Standards Focused Objectives, Purpose And Intent.

- The ***objectives*** **and** ***purpose*** is to provide guidance, document, and establish electrical safety requirements, standards, procedures, and safe work practices.
- The ***intent*** of these standards is to minimize exposure to these hazards and their associated impacts.

Development Process

- **Developed through a consensus standards development process approved and governed by ASE**, made up of vehicle manufacturers, aftermarket personnel and other electric industry subject matter experts.
- This process brings together volunteers representing varied viewpoints and interests to achieve consensus on EV safety issues.

Standards Development And Industry Review

- Standards **development** ongoing since early 2022.
  - Incorporated existing standards, studies and training on EVs and industrial electrical environments.
- **Multiple** review sessions and study groups with industry professionals to refine the standards.

A Living Document Continually Under Peer Review

- This is a living dynamic document and certification, as the xEV industry matures and develops, the standards will be reviewed and updated on a peer review schedule.

Designed With Conditions And Directives

- Required and ***Must*** be Met.

  Utilizing **SHALL** statements.

- Recommended and ***May*** be Met.

  Utilizing **MAY** statements.

Imbedded Conditions And Directives

Page 8

The technician **SHALL** carefully review **ALL** applicable OEM safety related repair manual procedures, training, and precautions **BEFORE** performing service.

Page 10

The technician **SHALL** refer to the employer's or manufacturer's specific guidelines, procedures and training when selecting the appropriate and recommended PPE.

All technicians **SHALL** remove **ALL** conductive items from their person; watches, rings, chains, body piercings, metal hair accessories, etc., prior to working on any xEV.

Technicians working on or near the xEV battery or energized components **SHALL** wear approved arc-flash flame-resistant (AR/FR PPE) clothing, made of natural fibers such as cotton, not polyester. It is possible that a uniform manufacturer may incorporate a polyester blend in clothing which could prove dangerous if involved in an arcing incident.

NOTE: HV PPE stamped with certification dates **SHALL NOT** be used if they have ***expired*** certifications.

Electrically insulated rubber gloves **SHALL** be worn on both hands when working near all xEV HV components, when energized, and **always** when working with the vehicle's HV batteries.

Insulated gloves offer personal protection against electrical shocks when working on or near live conductors and **SHALL** comply with IEC 60903 (International Electrotechnical Commission) and ASTM D120 (American Society for Testing and Materials) standards.

Fully insulated gloves **SHALL** be stamped for working voltages 1000 V ac and 1500 V dc, have a red-colored label with a voltage range and have an expiration date indicating a laboratory test within the last six months per OSHA law.

Sections Defined In Standard

A. **Purpose and Definitions**
B. **General Requirements for Electrical Safety-Related Work Practices**
   - Risks Associated with Electric Vehicle Repair
   - Vehicle Internal Safety Systems
   - Personal Protective Equipment (PPE), Physical Barriers, Signage, and Boundary Guarding
C. **Establishing an Electrically Safe Work Condition**
   - Required Knowledge and Skills
   - Responsibilities
D. **Safety Related Work Practices**
   - High Voltage Systems
   - Working Conditions
E. **Decommissioning and De-Energizing Procedures**
   - Steps and Procedures
F. **Test Instruments and Equipment for Electric Vehicle Applications**

A. Purpose And Definitions

LEVEL ONE

Electrically Aware Person

An individual who may or may not have received appropriate training to work on HV systems or components of the xEV vehicle.

LEVEL TWO

High-Voltage Vehicle Technician

A service professional, technician, or specialist who has:

- Received HV electrical training
- Demonstrated skills and knowledge related to the construction, operation, and repair of electrically powered HV vehicles
- Maintains an electrically safe working area

LEVEL THREE

High-Voltage Vehicle and Battery Technician

A service professional who has attained **LEVEL TWO** AND has received specific HV battery pack training, can perform “live work," and has demonstrated such skills and knowledge.

Which standard and exam is right for my team?

Electrically Aware Person

- Technician
  (Auto-Truck-Bus-Collision; up to the HV system)
- Service Manager
- Service Advisor
- Service Consultant
- Parts Manager
- Parts Specialists
- Parts Driver
- Collision Repair Estimator
- Sales Staff
- Cashier
- Facility Maintenance Staff
- Warehouse Staff
- Porters

B. General Requirements For Electrical Safety-related Work Practices

Identify and mitigate the dangers and risks when working on or near an electrified vehicle.

- Establish an electrically safe work condition.
- Provide for personal safety.
- Maintain a safe working environment.
- Built-in vehicle internal safety systems.

C. Establishing An Electrically Safe Work Condition.

What knowledge and skills are needed?

- Maintain personal proficiency in electrical safety.
- Safety concepts on and around an electric vehicle.
- Applications for personal protective equipment (PPE).
- Safety training and operational proficiency when working on and/or around electric vehicles.
- First aid and emergency response training.

D. Safety Related Work Practices

Identifying and understanding many of the safety related work practices.

- High Voltage Systems
- Accident Risks
- Wiring and Cabling
- Working Conditions

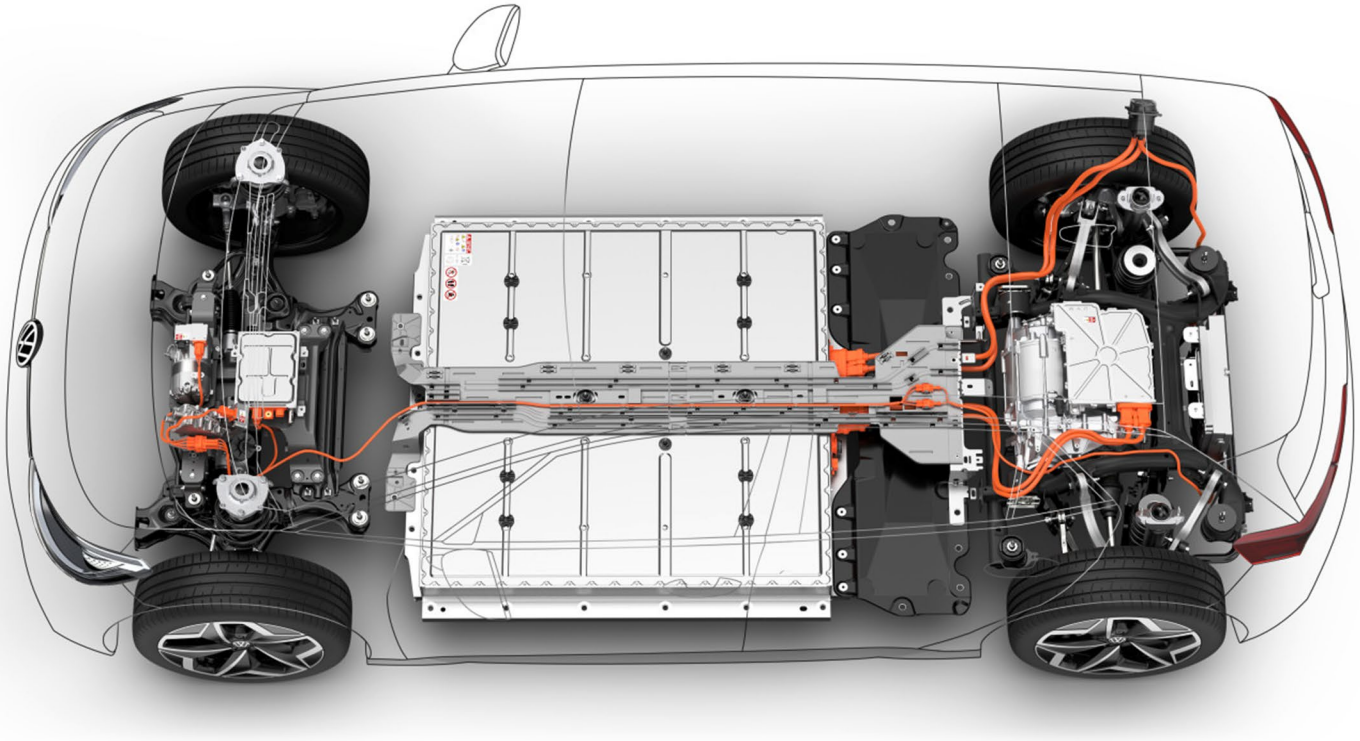


Image courtesy of autofile.ca

E. Decommissioning And De-energizing Procedures

When is it safe to work on the vehicle?

- De-energizing procedures.
- Steps prior to service or repair.
- Safety steps prior to making contact.
- Absence of voltage verification process (LDL).
- High voltage interlock (HVIL).
- Lockout/tagout (LOTO).

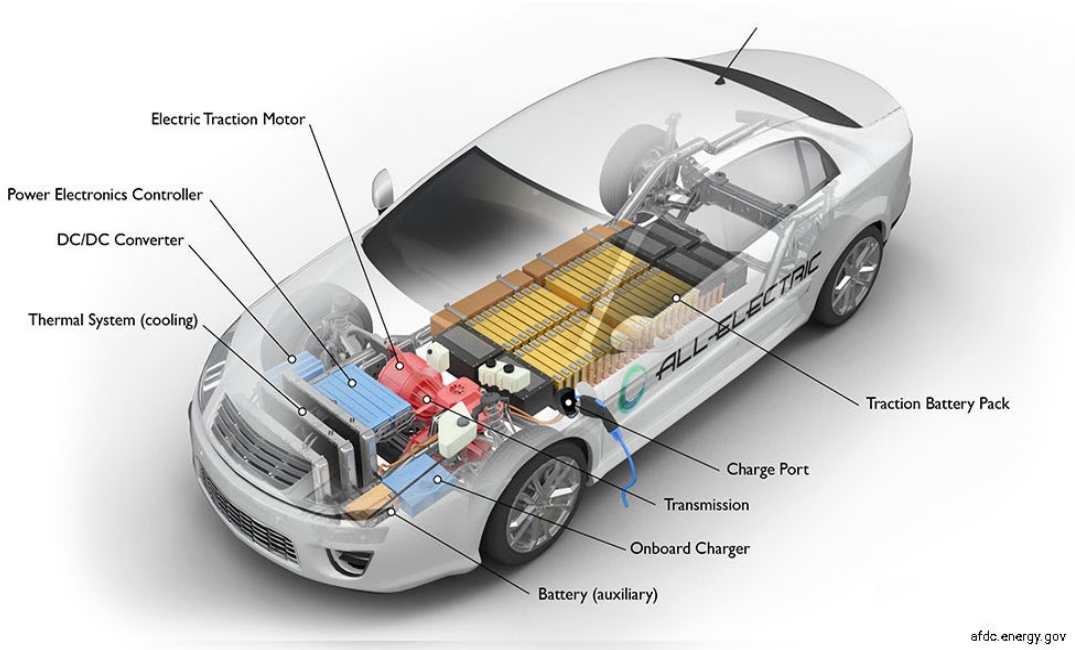


Image courtesy of Alternative Fuels Data Center

F. Test Instruments And Equipment For Electric Vehicle Applications

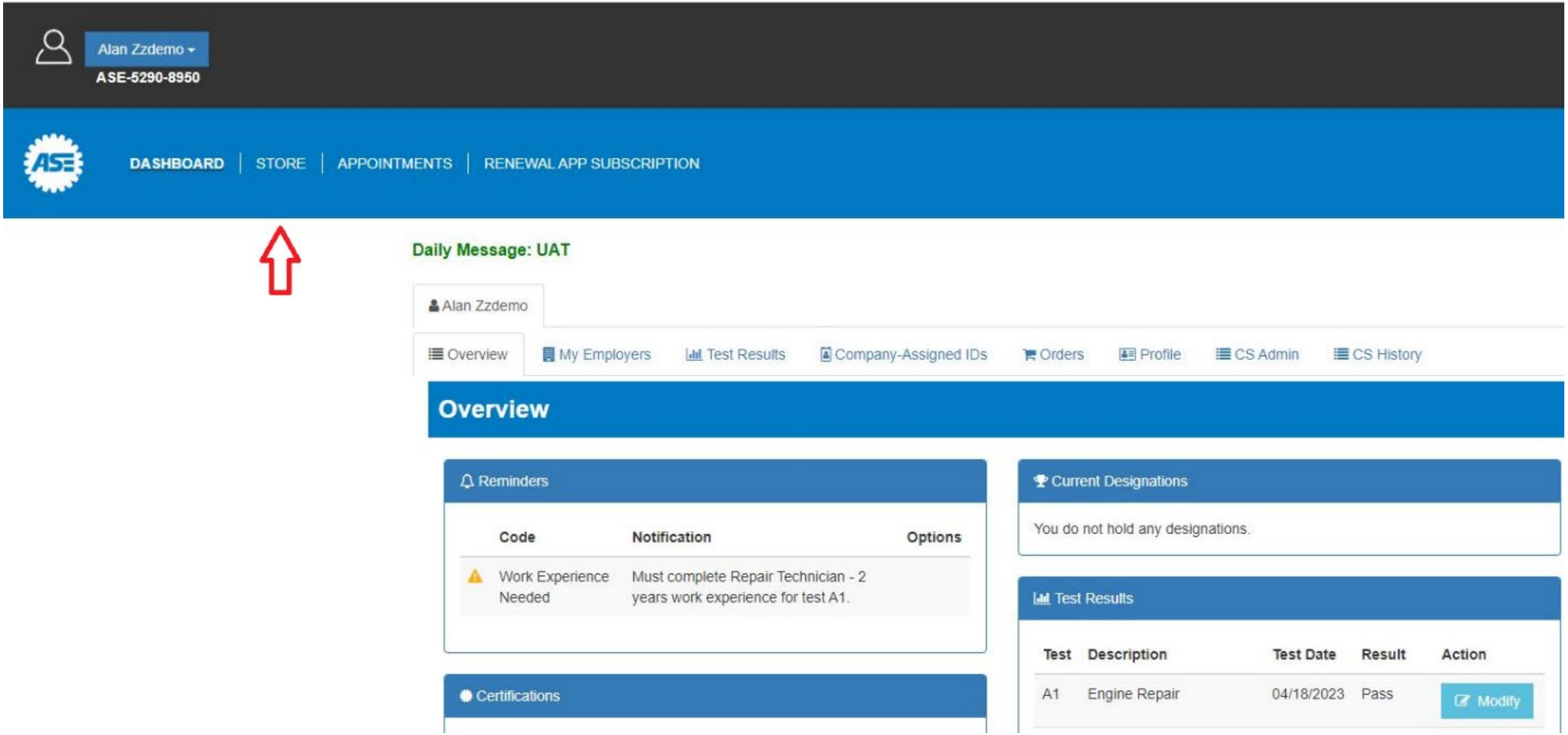
What test instruments and equipment are needed for safety related tasks and electric vehicle applications?

- Select the correct test tools and accessories.
- Understand test tool standards and ratings.
- Inspect the test tool prior to use.

New Testing And Certification Program

- xEV Electrical Safety Awareness Certification (**Level One**)
- xEV Technician Electrical Safety Certification (**Level Two**)

To learn more about the new ASE light-duty hybrid/electric certification program, visit **www.ase.com/ev**.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Reminders
Code
Notification
Options
Work Experience Needed
Must complete Repair Technician - 2 years work experience for test A1.
Current Designations
You do not hold any designations.
Test Results
Test
Description
Test Date
Result
Action
A1
Engine Repair
04/18/2023
Pass
Modify
Certifications

A: Auto

B: Collision

B6: Collision Estimator

C: Service Consultant

E: Truck Equipment

F: Alternate Fuels

G: Maintenance and Light Repair

H: Transit Bus

L: Advanced Level

MIL: Military

P: Parts Specialist

S: School Bus

T: Medium/Heavy Truck

X: Specialty

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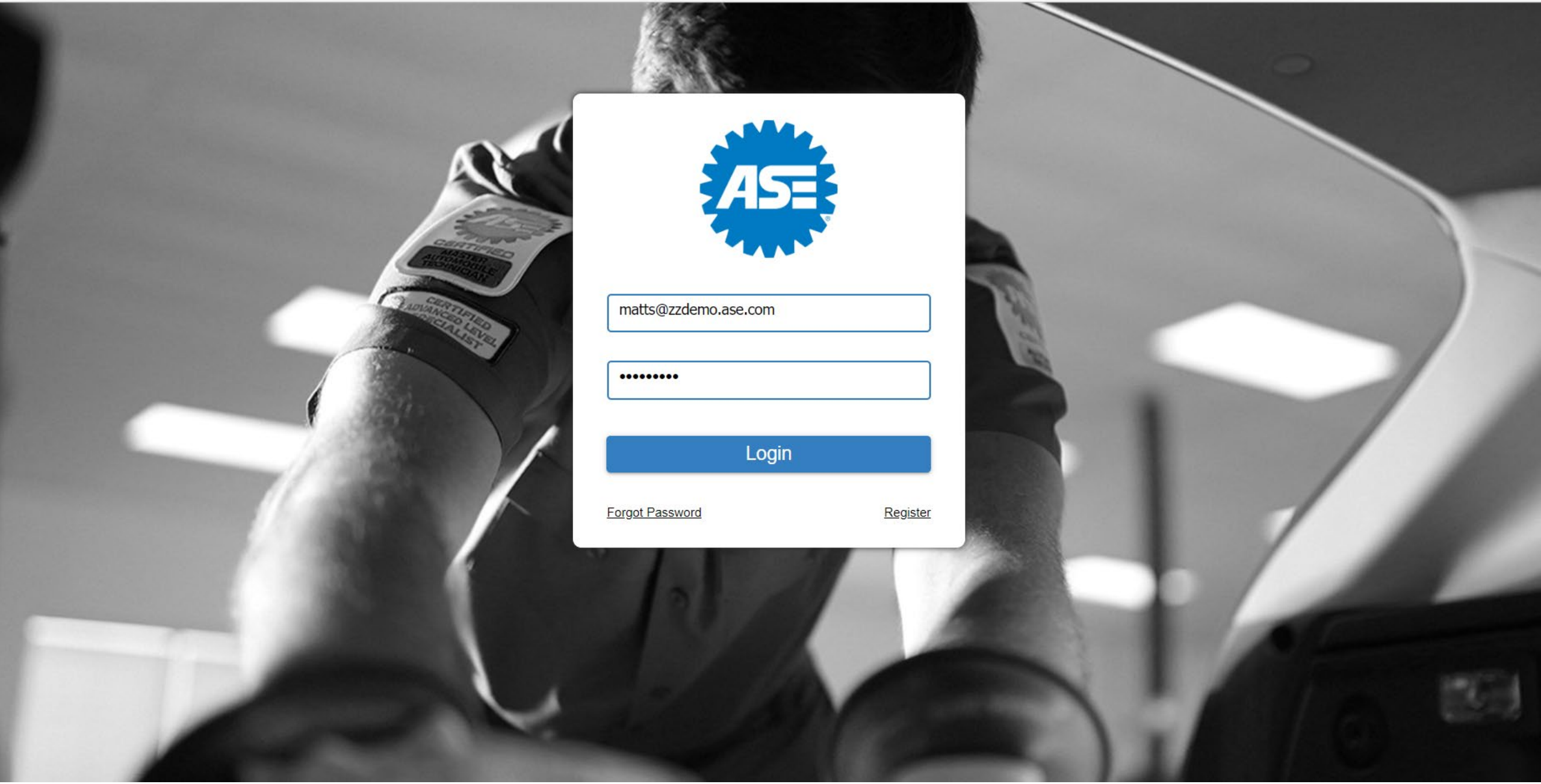
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Matt S

Last Name*:
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Home Email:

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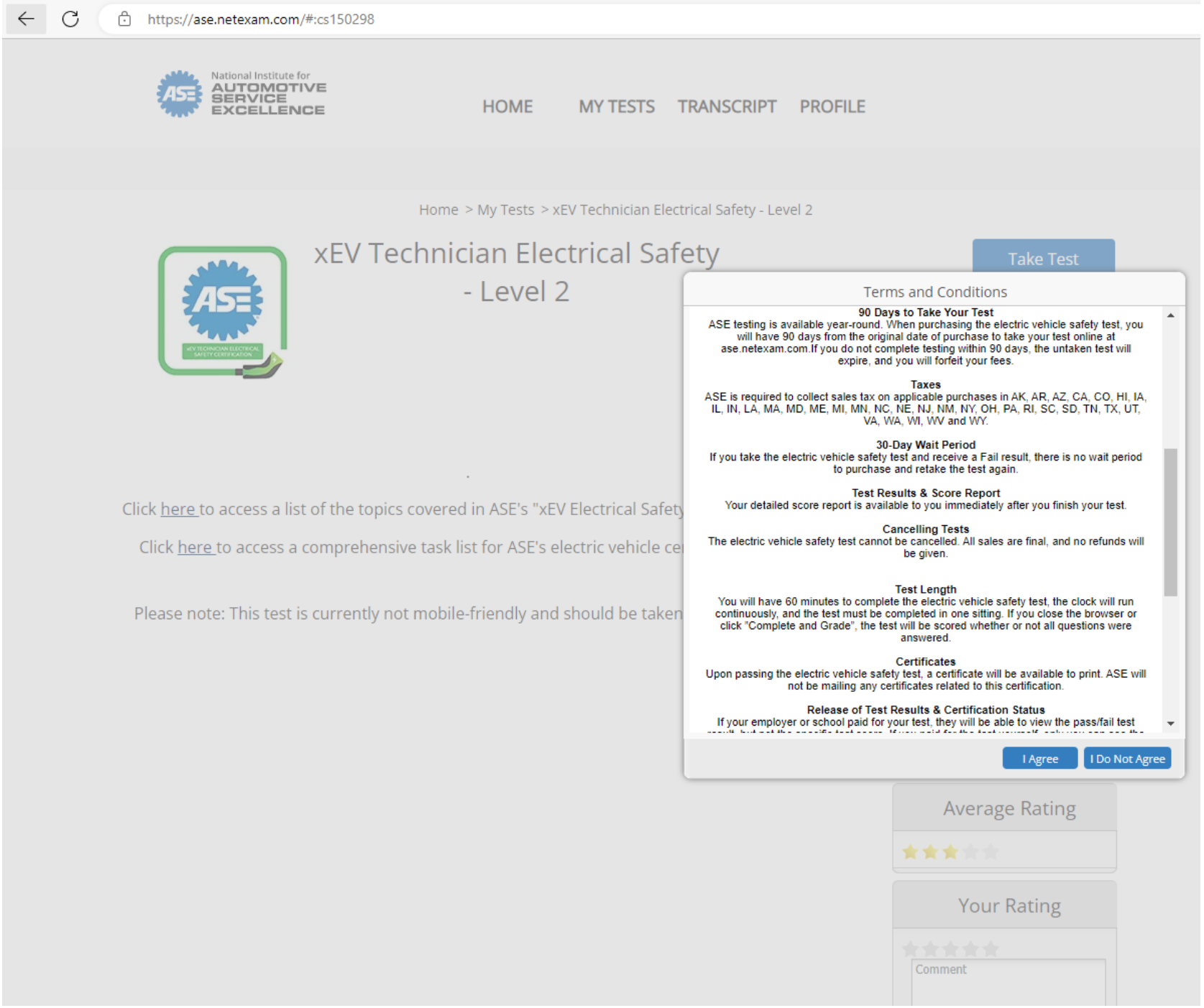
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TEST: XEV SAFETY AWARENESS EXAM

Question 2

Which of these procedures shall require the high-voltage system to be disabled on an electrified vehicle?

- Rotating the tires
- Replacing the cabin air filter
- Servicing a high-voltage component
- Changing the front brake pads

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2 of 20

TEST: XEV SAFETY AWARENESS EXAM

Question 3

Which of these statements about high-voltage (HV) battery charging on a plug-in hybrid electric vehicle (PHEV) or battery electrical vehicle (BEV) is true?

- To avoid overcharging, it is critical to unplug the HV charge cord when the battery is full.
- Charging an electrified vehicle in rainy conditions is dangerous.
- Charging a vehicle that was towed-in after a crash is dangerous.
- Wearing proper safety attire is recommended when plugging in the HV charge cord.

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TEST: XEV SAFETY AWARENESS EXAM

Question 10

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

A person who has received only basic high-voltage electrical awareness training should be able to demonstrate proficiency in any of these areas EXCEPT:

- identification of high-voltage components of electrified vehicles.
- identification of warning labels on or around electrified vehicles.
- understanding the safety concerns associated with electrified vehicles.
- understanding the high-voltage disabling procedure.

Previous

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TEST: XEV SAFETY AWARENESS EXAM

Question 20

If a fire in an electrified vehicle appears to be coming from the area of the high-voltage (HV) battery, the staff member should:

- disable the high-voltage (HV) system.
- evacuate the building/area immediately.
- disconnect the 12-volt battery.
- try to push the vehicle out of the shop to prevent the fire from spreading.

Previous

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TEST: XEV SAFETY AWARENESS EXAM

Question 20

If a fire in an electrified vehicle appears to be coming from the area of the high-voltage (HV) battery, the staff member should:

- disable the high-voltage (HV) system.
- evacuate the building/area immediately.
- disconnect the 12-volt battery
- try to push the vehicle out of fire from spreading.

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Please review your answers

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Questions Review

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The total score needed to pass **xEV Safety Awareness Exam** is **16** out of **20**

xEV Safety Awareness Exam

Content Area	Questions Answered Correctly	Total Number of Scored Questions
1.A0 Purpose	1	1
2.B2.1 Electrocution and Shock Hazard Risks	1	1
3.B5 Aiding Persons Subjected to High Voltage	2	2
4.C1.2 Safety Concepts on and around an Electric Vehicle	11	12
5.C4.4 Shops SHALL align with existing safety requirements and regulations	1	1

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This certificate is issued in recognition that

Matt S Zzdemo

has successfully earned

xEV Electrical Safety Awareness - Level 1

Issue Date: July 20, 2023

Expiration Date: July 19, 2026

Timothy A. Zilke

Timothy A.Zilke
President & CEO, ASE

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