



Automotive

## Electric Vehicle Manufacturing: Specialized PPE for Sensitive and Electrical Components

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For years, the United States has been the second largest manufacturer of motor vehicles, manufacturing over 1.5 million cars and 7.6 million commercial vehicles annually due largely to leading companies like General Motors, Ford, Stellantis and others. Today, these same automakers, along with EV giants like Tesla and smaller startups like Rivian and Lucid Motors, have shifted their sights towards the future with major investments in EV and Hybrid Vehicle Manufacturing.

Billion-dollar investments in new US-based state-of-the-art manufacturing facilities are set to create thousands of new jobs that demand different skill sets from production workers compared to the traditional motor vehicle supply chain. With these new technologies and facilities come new safety risks, calling for the correct PPE to protect the components used to manufacture EVs and the workers that craft them. So, what should safety managers be aware of to keep workers safe, comfortable and productive throughout the manufacturing process?

### OEM: PROTECT THE WORKER AND THE PRODUCT

Motors in traditional internal combustion engine (ICE) vehicles, otherwise known as gas powered engines, use over 2,000 moving parts to ensure proper operation. EVs are manufactured with only 18 essential internal parts that are made with extremely sensitive components and processes, all aimed to emit zero emissions and boost the intelligence of the car.

First, let's discuss what the term "sensitive" means in the manufacturing world. For decades, we have heard of microchips being used more frequently in manufacturing processes. "Microchip" is another term for a semiconductor, which is an extremely static sensitive and essential component that controls the electrical current within smart devices. Semiconductors are what allow smart electronic devices to communicate and compute properly. These semiconductors and other sensitive electronic components have traditionally been manufactured overseas, but companies like Marsh Electronics, Syscom Tech, Ebara Technologies and others are bringing manufacturing back to the US.

## Specialized PPE for Automotive Semiconductor Manufacturing

Semiconductors are used in just about all 18 of the parts of an electric vehicle to ensure it operates properly. Semiconductors are very static-sensitive and are manufactured in specialized environments that ensure static electricity doesn't build up to the point that it discharges and damages the product. These environments also require workers to wear specialized PPE to handle semiconductors safely. Wearing the incorrect garments or hand protection can lead to an electrostatic discharge that can cause the product to fail, costing a company time and money.

Humans generate static, but we also shed contaminating particles like dust, dander, skin cells and even respiratory droplets and bacteria that can damage sensitive semiconductor components. In order to avoid damage to these sensitive components, almost all gigafactories and controlled environment manufacturing facilities have mandated the use of **cleanroom-rated and ESD Safe PPE**. Cleanroom and ESD Safe PPE allows workers to operate in these environments by containing any shedding contaminants (also called bioburden) while also safely directing electrical charges to ground, preventing static buildup and discharge. The low current flows through the ESD Safe components of the PPE to protect the product as opposed to electrical insulating materials, which protect you from completing an electrical circuit to the ground.

PIP® offers **ESD Safe hand protection** in the forms of **gloves** and **fingercots** with styles that provide multi-hazard protection, including particulate protection for cleanrooms, extreme temperature handling, cut protection and chemical protection depending on the hazards and applications within the environment.

In addition to gloves, garments are also necessary to protect sensitive manufacturing products and processes from bioburden contaminants and electrostatic discharge. This complete line of **Uniform Technology®** branded garment solutions from PIP® offer cleanroom-rated particulate protection, and added protection from electrostatic buildup and discharge. Whether it is silicone wafer production, wire bonding/mounting, etching, or anything else related to automotive semiconductor, trust PIP® to provide the right PPE when working in controlled environments.

## Reduce the Risk in Lithium-Ion Battery Manufacturing

Lithium-ion (Li-ion) batteries are the main components that generate the power behind all EVs. The process to manufacture these batteries includes electrode production, cell assembly and cell conditioning and battery activation. These processes can expose workers to harmful chemicals such as lithium, cobalt, nickel and more during tasks like electrode paste mixing. It is important that proper protection is used around these types of harmful chemicals to avoid injuries.

Many safety managers in Li-ion gigafactories have implemented the use of cleanrooms or near-clean environments to avoid particulate contamination within battery cells. Why are particulates like dust bad for battery cells? Any particles or contamination within a battery cell can drastically affect performance and cause issues like internal short circuit, voltage drop and other issues to occur. Aside from the lint and dust that traditional garments shed, humans shed about 600,000 skin cells every day which is a major source of contamination. For these reasons, it is critical for workers to use the correct PPE to reduce the risk of particulate contamination and protect the integrity of these extremely complex and expensive components.

## EV AFTERMARKET MAINTENANCE & REPAIR

Similar to the OEM sector of EV manufacturing, aftermarket care and maintenance is in many ways different than traditional internal combustion engine (ICE) vehicle maintenance. Overall, EVs require far

less maintenance than traditional motor vehicles, however, technicians must be certified to perform the necessary steps of EV service and maintenance. Sure, some EV vehicle parts will still require traditional service and maintenance such as break replacements, tire rotations, tire alignments, break fluid checks and more... but what is the key difference that requires an advanced approach to safety?

## Choosing the Right PPE for Battery Maintenance Safety

Unlike motor vehicles, EVs have high voltage Li-ion batteries located in the front or rear of the vehicle. Today's typical EV Li-ion batteries range from 400-800 volts and in almost all cases will require a disconnect in order to conduct safe aftermarket work. The master disconnect, also known as a "service jack," is what generates a circuit to the battery when plugged in and is required to be removed by technicians to achieve a proper power down.

To do this, it is essential that technicians are equipped with the right **electrically rated insulating gloves** (at the very least) to avoid an electrical shock, or worse, electrocution. Electrical insulating gloves are classified 00-4, each class rated to provide a specific level of dielectric protection to the specific voltage level being worked on. As a leader in electrical safety to automotive, manufacturing, utility and other markets, PIP® has created the reference chart below to identify what voltage level each class of **NOVAX®** electrical insulating glove has been tested to.

CLASS	TEST AC VOLTS	USE AC VOLTS	USE DC VOLTS	LABEL COLOR	LABEL IMAGE
00	2,500	500	750	Beige	
0	5,000	1,000	1,500	Red	
1	10,000	7,500	11,250	White	
2	20,000	17,000	25,500	Yellow	
3	30,000	26,500	39,750	Green	
4	40,000	36,000	54,000	Orange	

Depending on the voltage of the battery being used, glove selection should be determined based on the maximum voltage output of the battery technicians are working with. Each class of gloves is clearly marked with the maximum use voltage on the permanent color-coded label. So, if the average battery voltage ranges from 400-800 volts, it is safe to assume that a pair of class 0 gloves will provide the adequate amount of protection necessary to power down the battery. **Voltage levels should always be identified by the end-user prior to glove selection.**

Under most circumstances, **leather protectors** should be worn over an insulating unless the dexterity required to perform the task requires that rubber insulating gloves are worn alone. OSHA has specific

requirements associated with the use of protectors and the end-user is responsible for making sure they comply. It is critical to note that a leather protector alone does not provide any electrical insulating protection.

## **PROTECTING WORKERS FROM START TO FINISH**

Fully understanding the intricacies of EV manufacturing from start to finish is a daunting task. Learning the key safety demands of workers in OEM, Mainline Assembly/Fabrication and Aftermarket Service/Maintenance can help safety managers provide the right solutions that keep workers comfortable, efficient and most importantly, safe. No matter the sector of manufacturing, PIP® has the right head-to-toe solutions to protect against the advanced hazards associated with EV and Hybrid Vehicle manufacturing.

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