Bolt of an idea: Yazaki’s arc suppression

Cable supplier devises a way to avoid damage

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Engineers at Yazaki North America in Canton, Mich., are helping to protect vehicle occupants and service shop technicians by preventing high-voltage system failures in electrified vehicles.

A failure caused by a high-temperature electrical arc — often thousands of degrees — is possible whenever an electrical device or motor is turned on or off. That’s because the arc energy created between the switch plates of a contactor can weld or degrade the platting that conducts the current. Yazaki’s solid-state arc suppression device detects an arc situation and reacts to it in less than 100 microseconds to protect the circuit, says John Romain, senior manager of advanced development for Yazaki North America Core Engineering.

“U.S. manufacturers have been moving their focus to battery-electric vehicles,” Romain told Automotive News. “But this requires a significant amount of cabling, which can be costly and heavy.”

“That’s why manufacturers are moving forward with higher-voltage motor drives. They need a lot of power with as little cable as possible.”

Core competency

The science of cables is a core competency for Yazaki, which supplies wire harnesses to automakers around the globe. The solid-state protection circuit absorbs energy through electronic components in a circuit that can be used in existing power distribution devices.

The safety device is available as a verification-ready circuit, with Yazaki working with automakers to size it for various voltage needs. A 1-by-1-inch cube arc suppression device is necessary for a 48-volt vehicle. A higher-voltage vehicle may scale up to a 2-by-2-inch device, Romain said.

“The device uses the arc energy to power the suppression circuit, he said, which means that the circuit draws no power when there is no active arc,” according to Romain, the device protects the entire circuit, including connectors, switching contacts and the load device itself.

“The design of the device was necessary to disconnect the 12V GND terminal on the battery to safely service most of the electrical system,” he said. “This was not adequate to protect against arc with the introduction of high-voltage systems in vehicles.”

Yazaki’s John Romain says the arc suppression device is “like auto insurance. You pay a little to protect yourself from a huge bill.”

Servicing electrified vehicles

Yazaki’s development was also motivated by the increasingly common scenario of servicing electrified vehicles.

“Regardless of how reliable vehicles become, they will always require some type of maintenance over their usable life,” Romain said. “And not everyone follows safety rules during a maintenance procedure.”

“The first step of a typical modern repair is to disconnect the 12V GND terminal on the battery to safely service most of the electrical system,” he said. “This was not adequate to protect against arc with the introduction of high-voltage systems in vehicles.”

“Arc suppression devices have the value of absorbing arc energy that could generate a spark,” Romain said. “Those sparks can damage wire and terminals or could ignite flammable materials injuring vehicle occupants.”

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Yazaki’s Yuan Wu, left, demonstrates the difference between an unsuppressed arc and a suppressed arc at the company’s lab. Above, the arc suppression device can react quickly to protect a circuit.”

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