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Lucas-Nuelle recently partnered with the SkillsUSA Automotive Service Technology Technical Committee to run the world's first ever skills station to test the competitors' knowledge and skills on high voltage vehicles. SkillsUSA is one of the largest skills contests in the world and is for high school and college students in many different fields.

The task that was selected was a shut down, or isolation of the high voltage system. There were no faults to find or "tricks", just shut down the system and declare it safe before reinstating it. The CarTrain electric vehicle training systems which are part of the Lucas-Nuelle line up were used for this assessment. These systems have been designed to give a realistic experience, while being 100% safe for the competitors and onlookers. Safety has been one of the factors why hybrid vehicles have not been a part of any skills contests in the past. On reflection, this proved a sensible decision as had real vehicles been used, some competitors would have placed themselves in real harm.

Without going into details of the station, as many other countries now want to incorporate this into their skills events, I want to share with you the critical safety issues that we found during the competition. The competitors were given a selection of HV gloves, DMMs, measurement leads and other measuring and safety equipment; more than they needed to perform the task. This was designed to make the competitor consider the scenario and the options and make a choice, as we were testing who is the best of the best! A lot of students told us as they started the station that they had never studied or worked on hybrids or electric vehicles, which was fair enough, not everyone is teaching it yet, but as they were told "all the information you need is in the supplied manual".



### **The skills gap with our next generation of technicians**

The contest gave us a very interesting, honest look at the skills of the students that are being trained now and I think it is something that urgently needs to be addressed. We can't allow these young trainees to be unprepared for something that may not be ubiquitous yet, but will be at some point in their career. These vehicles are out there en masse and almost every week we see a new model on the market and this trend will only continue. These vehicles are here to stay and it's not a big stretch to say that every technician in training right now, will be exposed to high voltage vehicles at some point in the not too distant future.

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It's much better for a student to learn about what they need to do to keep safe while in school, than to wait until they are in the workshop, possibly under pressure to experience a high voltage vehicle for the first time.

The following is my findings on the station and what teachers need to focus on, at the very least, to ensure this new generation of techs are safe. Now, before you say "my program doesn't or can't afford the vehicles, or I don't have the expertise yet", just wait, I'm not talking technical things here, such as inverters, high voltage batteries and 3 phase motors, megaohm and milliohm testers. I'm talking pure safety, things that anyone can at least cover in any class. Those other things are very important and will be required to train HV techs, but let's make sure that all students are at least prepared for when the day comes that they will see a HV vehicle, whether they want to or not.

Here are some of the things to pay attention to:

**Gloves.** PPE is the last line of defence and even if you have done everything else wrong, it should keep you safe. If you have the correct PPE that is. The competitors needed to select from various pairs of gloves. The students need to be aware of the following:

- Correct class of glove. Some students had no idea which Class is required for EVs.
- Testing procedure. How to test a glove in the workshop.
- Date stamp. How long is a glove safe to use after being tested at a certified laboratory?
- How to use leather gloves if used. A LOT of competitors had the leather gloves under the rubber gloves. The leather gloves are only there to protect the rubber gloves, so not very helpful in this case.
- We even witnessed some competitors remove HV components with no gloves at all!

**Measuring equipment.** One of the most important things to do when isolating the HV system, is to verify that the system has been isolated and there is no voltage measured in the system and ensure it is safe to work on. Correctly rated equipment in good condition is an imperative. The students need to be aware of the following:

- Correct CAT rating for the meter, usually CAT III
- Don't forget the leads for the meter, a lot picked the correct meter, but wrong leads, which then become the weak link!
- Some laws call for the use of the "one hand rule", ensuring that only one hand is in contact with the circuit at a time, to further reduce risk of electrocution.

**Workshop manuals.** RTFM (Read The Factory Manual!). You need to know what you are working on and understand when it is safe or not. We had students removing service plugs without gloves, taking the verification measurements at the wrong spots, not securing the vehicle against someone else starting it, amongst others, even though the procedure was clearly stated in the manual. This can be of course attributed to the pressure of the situation and no prior experience, but this will happen again one day with an impatient service manager, or a customer who needed the car an hour ago. The students need to be aware of the following:

- HV components (what to touch and what not to touch).
- Isolation procedure. There are many different ways and methods to shut down HV systems and students should be at least aware of them.
- Verification procedure. While every vehicle has many levels of failsafe built in, it is always important to test to make sure the voltage in the capacitors has dissipated.
- Lock out/Tag out. Placing the key and the service disconnect in a lock box will ensure that no one attempts to start the vehicle while you are working on it.

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- Safety of others. You may be required to surround the vehicle with a safety barrier to ensure others are aware the vehicle must be avoided.



### **It's time for a debate on training, licensing and its consequences for the industry**

It's time to start a discussion on what the future of technician training is going to be. I have outlined here below a couple of examples from around the world to get a glimpse of what other countries are doing.

Some countries are pursuing licensing of HV technicians, for example, in the UK, the IMI (Institute of the Motor Industry, the UK's Sector Skills Council for the automotive industry with national and international qualifications) is working with the UK government to ensure that adequate training is given to everyone and the approach to guarantee this would be to require technicians to be licensed to work on HV vehicles. The IMI has existing standards that have been developed and evolved as the technology changes that would form the basis of such training and the UK Department for Transport strategy paper, "Road to Zero" which underlines their commitment to work with the IMI and other key stakeholders to move towards licensing. Many countries require a license to work on AC systems, so it is conceivable that licensing be required for working on HV vehicles.

Germany has a slightly different approach, their standards have been developed by the National Occupational Health and Safety Organisation (DGUV in German), so this means that training is now coupled to OH&S laws, so if you are hurt while working on HV vehicles and you have not done the correct level of training, you are not protected by these laws. This also includes the management of an organisation that must ensure that their employees have the correct level of training and correct safety equipment and tools needed to perform their job.

Both the German and UK training standards include various levels of training according to the job requirements, such as stage 1 is a general awareness type of training for drivers, managers and other non-technical staff, stage 2 is for technical staff that can shut down a HV vehicle, and then work on the vehicle once it has been verified to be free of voltage. Stage 3 is working on live high voltage systems, such as high-level diagnostics and working on the high voltage battery. This training obviously requires the highest level of training and assessment. Another special type of training is given specifically for fire fighters and rescue personnel on how to identify, approach and deal with damaged vehicles.



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I can also imagine that it won't be long before insurance companies require technicians working on vehicles to be certified or licensed before they can even touch the vehicles, as they will not accept responsibility for the technician or the vehicle owner/driver being hurt as a result of the repairs carried out by untrained technicians. Who would be liable in this case? The person who fixed the car, or the insurance company that authorised the repair? That's not a trivial question.

Thanks for reading and I look forward to hearing your comments or if you have any questions, please let me know!