WORKING KNOWLEDGE BY TERRY MACKENZIE HOY

THE RISE OF ELECTRIC CARS

The future of cars will be in some way electric. The general style of technology for an electric car drive was a dc motor driven off lead acid batteries; the dc motor drove the wheels directly. The result was a heavy car with an awkward centre of gravity which made the suspension a challenge and there was very little protection from collision related injuries.

Such cars were more 'technology demonstrators' than actual commercial products. Alan Cocconi of AC Propulsion approached the problem in a different way. He knew that the motors used on commercial aircraft operate at 400 Hz and thus a 22 W motor running at this frequency was very much smaller than the equivalent motor with the same rated power. Of course a 400 Hz motor with four poles operates at about 12 000 rpm and could not be used to directly drive the wheels of the electric car. However, if the wheels were driven by a gearbox the situation would resolve itself. Cocconi used a Honda gearbox indexed to second gear for this purpose. To drive the motor he designed a 48 V/400 Hz inverter which used thyristors fixed to heat sinks the size of hockey pucks. He still stuck to the old lead acid battery.

Tesla effectively copied this design but replaced the lead acid batteries with lithium ion batteries as used in cell phones.

With regard to electric cars we are more or less at the same point that computers were at in the early 1980s. There was no such thing as a standard computer; Hewlett Packard, ICL, Apple and Wang had computers that worked on different systems. Then IBM produced a desktop computer which used a little online operating system called Microsoft-DOS. This made the IBM product far superior to anything else and it became the standard for industry.

With electric cars we are not quite there yet. The next step to take us to industry standard will be to get rid of batteries and replace them with 'fuel cells'. I think we all know that if you connect a metal plate to the positive of a battery and a metal plate to the negative of a battery then hydrogen gas will bubble off one plate and oxygen off the other. A fuel cell works in reverse insofar as an enclosed cell has pure water in the central compartment and the central compartment is separated from the two side gas compartments by means of membranes. Hydrogen gas is pumped into one compartment and air (which contains oxygen) is pumped into the other. These two combine to form water and produce electricity.

Fuel cells have been in existence since the 1970s but are still very expensive compared to batteries. They are, however, much lighter. It is only a matter of time before they replace batteries in electric cars which will be light and completely non-polluting. Critics point out that this will require the car to have a tank full of hydrogen which could explode in any vehicle collisions. The explosion part is a possibility, but is very unlikely. Another matter is driverless cars. Tesla in particular pushes these. How likely is it that the detectors in a driverless car will detect a person who has decided to walk across a freeway, lane by lane? Or an animal? The USA National Highway Traffic Safety Administration (NHTSA) has adopted Automotive Engineers International definitions for levels of driverless automation. Level 0 is a car where a human does the driving and level 5 where the car does all the driving without any human assistance. Effectively, right now there are no level 5 cars. However, the definition of level 4 is: 'A vehicle's ADS can perform all driving tasks and monitor the driving environment – essentially, do all the driving – in certain circumstances. The human driver doesn't have to pay attention during those times.' One has to wonder how we will find out what 'essentially' and 'certain circumstances' mean. Future generations of electrically trained people have a whole new interesting world to deal with when electric cars become common place.

ON THE GROUND WITH JONAS E MUKUPO

CONTRACTORS AND SANS 164-2

I am back again with a topic that basically touches on issues pertaining to electrical contractors with regards to the new regulations already effective from 16 January 2018, with emphasis on the requirements for socket outlets.

I recently attended a workshop on the 10th of May 2018 at ECA offices in Cape Town, hosted by George Senekal. It is unfortunate that many of those in the business missed this because of other commitments regarding work, but the ECA workshops are very helpful in keeping us abreast with the new regulations that come into effect from time to time.

One thing I noticed is that the SANS 164-2 regulations for socket outlets was introduced last year already and only became effective this year in January, and by attending the workshop, it was a good eye opener for me and all those who attended. The other thing my fellow contractors need to know is that these workshops are open to both members and non-members of the ECA to attend (at a small cost to cover refreshments and printed documents of the topics covered on that day to take home, which is a good thing as you can always refer back to these).

Let me get to the crux of the matter. The new law on socket outlets refers to new installations that are being built as from when the law became effective, which is from the 16 January 2018. All contractors must be aware that in any new installation built after this date, socket outlets must have at least one SANS 164-2 socket incorporated on it, meaning no SANS 164-1 socket outlets for the normal round plugs will be installed on their own, be they single or double on new installations.

Manufacturers have already ramped up production towards achieving this to comply with the law and it is the duty of every contractor to follow through on that as well. By diamond shape, I mean a socket where you can connect a radio or TV (two pin plug) and on these, there is provision to connect to earth, hence new plug tops have three pins and can easily fit in that diamond socket since it has three holes, one being the earth point.

At first glance it looks like a futile exercise, but there is a safety aspect behind all this. Imagine someone struggling to pull out a round plug top for a toaster or electric kettle. Most of the time the plug can come out half way while the pins are still in contact with the supply from the socket outlet. Oftentimes, we are tempted to insert anything in between to wiggle it out. It could be a knife or a spoon and that is when disaster strikes. Imagine if your fingers or those of a child accidentally make contact with the live pin of the plug because it is half way out and you get 'zapped'.

With the new SANS 164-2 plugs, there is no contact to live parts, mainly because you pull out the plug top and will not at any time get your fingers close to the pins. Even if the plug top is pulled half way out, the live part or parts remain covered by the plug top itself. Remember, these diamond plug tops do not sit flush with the socket outlet as with the round plugs, but sit right into the indentation on the plug top. It sounds unnecessary, but this was decided with safety in mind. New laws are already out to amend the CoC by taking some sections out and who knows, it might be reduced to one page. There will be enforcement of CoC's just for earthing systems, solar or PV and MV installations out soon, hence I urge contractors to attend the courses offered by the ECA to keep abreast with the new laws happening in our electrical industry. As we all know, 'ignorance is no defence'.

KSB PUMPS FOR UNIVERSITY OF PRETORIA LABORATORY

KSB Pumps and Valves has assisted the University of Pretoria in the construction of a large controlled-temperature test unit, which will form the backbone of ongoing research into heat transfer, fluid mechanics and thermodynamics.

The impressive unit will allow students to plug directly into hot, moderate or chilled liquids to use on research projects and will shave approximately 50% off students' overall project build-up time thereby allowing more time to carry out actual research. In addition, it is expected to save considerable costs in future.

Chairman of the School of Engineering and Head of Mechanical and Aeronautical Engineering, Professor Josua Meyer, says the multi-million Rand project was part-funded by the University, with donations from industrial companies like KSB Pumps and Valves for funding, equipment and construction of the system.

About the centralized temperature-controlled unit, the Professor explains that the system relies on temperature monitoring of flow loops where water is conditioned through the relevant heat pumps and chilling units at near boiling or lower temperatures, as well as subzero degree Glycol at -20°C.

"The user demand within each loop is controlled using a system of pumps, variable speed drives, pressure transducers and special valves to allow up to eight experiments to plug-in simultaneously without affecting either the flow rate, working pressure or temperature of the unit. This calls for absolute reliability and requires the best possible equipment to be used to avoid downtime that may impede any of the research programs," says Danie Gouws, Technologist of the laboratory.

"In the research laboratory reliability is of the utmost importance and means that the University will not compromise on quality and will procure the best, most suitable equipment that money can buy."

This meant that through its learned-team, the University specified five Etanorm 50/32/250 pump sets with 3 kW, 2.2 kW and 1.5 kW motors respectively according to flow rates, required pressure and other requirements. With their proven reliability and unwavering performance, they were selected to accomplish the main pumping requirements of the complex system.

PLC-control ensures that all parameters are checked and balanced to ensure the system delivers fluid at the right temperature set points and flow conditions 24-hours per day, regardless of the number of students using the facility. It also ensures that ongoing and larger-scale research projects can be undertaken, including some cutting-edge research that is already being done in collaboration with other international Universities.

KSB Pumps and Valves external sales representative, Dylan Mitchell, says the company was initially approached by Ascend Consulting Engineers to obtain data on the pumps. The company later revealed that a project was being undertaken for the University and that sponsorships were being sought.

"In this regard we are always ready to assist educational institutions and gave the thumbs-up to the project. Wherever technical assistance was required we were happy to weigh-in with our expertise, but must commend the University, consulting engineers and the contractors who worked tirelessly to deliver a world-class installation.

"As a result, we are proud to be associated with this prestigious project which lends itself to assisting future engineers to change the face of tomorrow. This is another feather in the KSB cap."

With the system up and running, Professor Meyer concludes that the project is already proving to be a great success with numerous research projects already plugged-in. "We are thankful for the ongoing support of companies to the cause of our students and the University."

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