TECHNICAL REPORT

I-CAR NEW ZEALAND

ELECTRIC VEHICLES- WORKING WITH HYBRIDS, PLUG-INS AND ALL-ELECTRIC PLATFORMS

SAFETY FIRST..... AWARENESS IS ALL IMPORTANT!!!

The technical report that featured in the previous PanelTalk edition looked at identifying the various different electrically powered vehicle configurations, in brief. With the exception of Fuel Cell Electric Vehicles (FCEV), panel and paint facilities across the country will be seeing more and more of these vehicles in their workshops, for all manner of repairs, from cosmetic damage to major structural repairs.

With this in mind, it is entirely appropriate that we look to understand everybody's exposure to not only the cost of making mistakes (component damage and cycle time delays), but more importantly, The SAFETY and WELL-BEING of those working in or around these types of vehicles.

While arguably very few of those involved in the collision repair industry, have a great understanding of electricity, and electrical systems, it is of paramount importance that some basic information is learned and understood by all of those that work within our businesses – from the receptionist and damage analyst (estimator) right through to the car groomer / detailer, in order to minimize WorkSafe issues, maximise efficiencies, and prevent unrecoverable costs.

In the first instance, we need to understand some basic terms. Very few of us understand the difference between current, voltage, amperage, resistance and wattage, as examples.

The 3 most basic units in electricity are :-

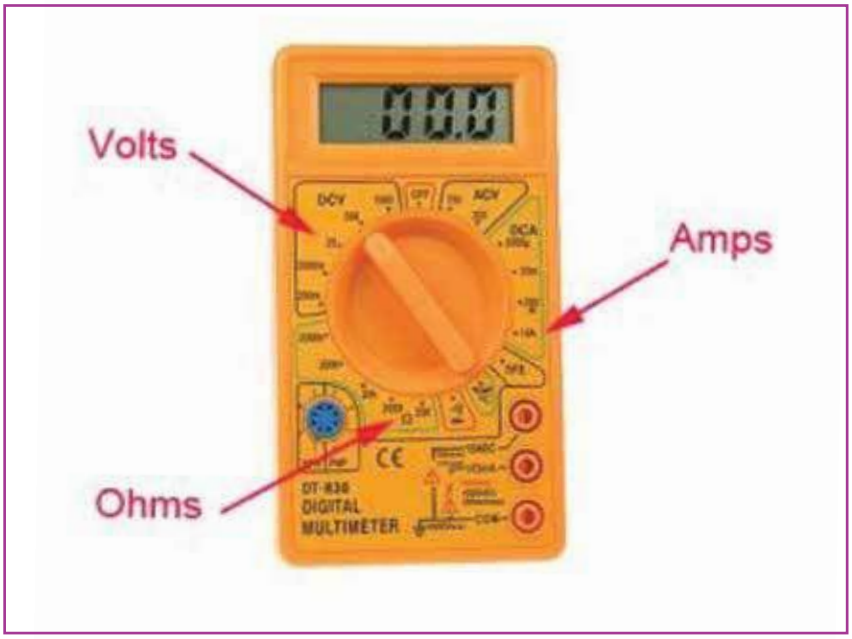
1. Voltage (V) - Measured in VOLTS
2. Current (I) – Measured in AMPS
3. Resistance (r) -Measured in OHMS

To better explain this, and how it impacts on us when working in and around potentially hazardous electrical components, let's use an analogy that describes a liquid (e.g. water) moving through a pipe – as in plumbing.

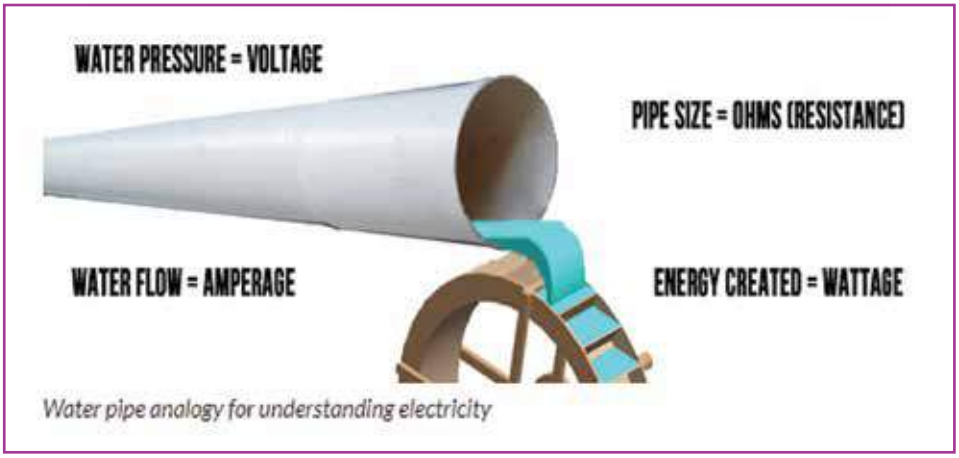
VOLTAGE is equivalent to the water PRESSURE
CURRENT is equivalent to the FLOW RATE
RESISTANCE can be referenced as the PIPE SIZE (Diameter)

Therefore, in electrical terms :-
Changes in PRESSURE will affect VOLTS – Measured in VOLTAGE
Changes in FLOW RATE will affect CURRENT – Measured in AMPS
Changes in WIRE SIZE will affect RESISTANCE – Measured in OHMS
WATTAGE describes the amount of POWER that is produced by VOLTS X AMPS

On a Multi-Meter, we identify -

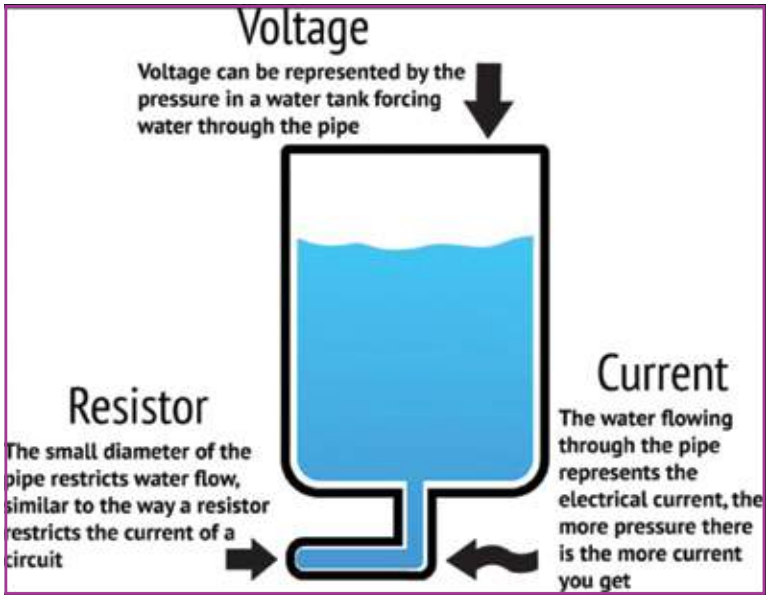


TO VISUALIZE THIS :-



Water pipe analogy for understanding electricity

OR RESISTANCE (Ω) :-



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Awareness and Knowledge is far better that Ignorance and Fear!!

Excerpt from Health & Safety Executive (HSE) - U.K. Government

Risks of working with E&HVs

E&HVs introduce hazards into the workplace in addition to those normally associated with the repair and maintenance of vehicles, roadside recovery and other vehicle related activities. These include:

- The presence of high voltage components and cabling capable of delivering a fatal electric shock.
- The storage of electrical energy with the potential to cause explosion or fire.
- Components that may retain a dangerous voltage even when a vehicle is switched off.
- Electric motors or the vehicle itself that may move unexpectedly due to magnetic forces within the motors.
- Manual handling risks associated with battery replacement.
- The potential for the release of explosive gases and harmful liquids if batteries are damaged or incorrectly modified.
- The possibility of people being unaware of vehicles moving as when electrically driven they are silent in operation.
- The potential for the electrical systems on the vehicle to affect medical devices such as pacemakers.

THERE ARE SOME BASIC FACTS THAT THE AUTO BODY TRADE HAVE A GOOD UNDERSTANDING OF :-

- Most of the vehicles we work with are either 12 volt or 24 volt systems.
- Electronic awareness in Body Repair Manuals (BRM), and other literature continually references battery disconnection, and regular component removal, when welding and carrying a myriad of operations on later model vehicles (especially so when working within close proximity of electronic features).

Undeniably less well known and often confusing, is what is considered to be SAFE "casual" levels of human exposure or contact with electricity – This is a very polarising question, simply because there are so many variables, such as wet or dry skin contact, the time or length of contact, large or small contact area(s), types of clothing and footwear, Alternating Current (AC) or Direct Current (DC), levels of resistance, and so on. A great deal of discussion revolves around not just the amount of VOLTAGE, but also the amount of AMPERAGE that is present in any electric shock scenario.

General consensus among Subject Matter experts (SME□) would suggest that any casual human contact over **30-50 Volts** and above **0.2 Amps** is more likely to cause injury or death, under "normal" conditions.

That being said, accidental contact with a 12 Volt power system is unlikely cause death or serious injury, but the High Voltage (HV) battery found in electric vehicles is considered to be ***extremely dangerous.*** For that reason, the HV battery and its associated components are controlled entirely by the conventional 12 volt system – this isolates and prevents the engagement of the HV power whenever anomalies or faults are detected. If the 12 Volt system is not operational, the HV system WILL NOT FUNCTION.
High Voltage (HV) batteries are Direct Current (DC) power, can range in voltages from 200 to 600 Volts, and be up to 60 amperes (amps).
Electronic awareness and in particular, safety, become absolutely paramount when working in close proximity with, or when handling the HV battery and its□connected components.

SOME BASIC POINTS TO REMEMBER ARE :-

- *The HV battery has an isolation switch known as the **SERVICE DISCONNECT.***
- *All wiring and components that carry higher voltages (above 12 volts) are identified by colours other than black – these are typically BLUE or YELLOW up to 36 volts, and ORANGE for any voltage over this. ALL orange coloured wiring, and sheathing will be **HIGH VOLTAGE.***
- *The HV battery may not necessarily require removal, but will need protection from sparks, excessive heat and abrasive grits etc.*
- ***ANY** contact with the HV battery and parts (including the Service Disconnect), must be done with the operator wearing the appropriate electrically insulated rubber gloves- additionally, these need to be protected by suitable leather protective gloves.*

Service Disconnect examples –

High Voltage wiring sheathing and plugs will be ORANGE

Use Lineman's class 00 gloves in conjunction with protective leather outer gloves

This is by no means a comprehensive document on Electric Vehicle safety – as with most repair and safety operations that are required when repairing the new age of motor vehicles, OEM information and specifications should be referred to, in the first instance…

*I-CAR's course, **ALT03 – Alternative Fuel Vehicle Damage Analysis & Safety** provides further information on working with electric vehicles.*

These articles have been written by Martyn Lane : I-CAR Instructor, Weld Test Administrator and Technical Specialist to the auto body industry.