

Section 6: ELECTRICAL SYSTEMS

Requirements for Systems Operating at Voltages within the LV Range

6.6 – 6.13

1. Concept of Self-Powered Mobile Device

Our **over-riding and basic premise** is to treat our locomotives as SELF-POWERED MOBILE DEVICES like normal-sized railway locomotives, ships, aeroplanes, cars, trucks and mining and military equipment. Certainly ships and planes must comply with local standards as they both plug into mains power when docked. All of these mobile devices suffer from vibration and therefore must be wired to minimise the effect of said vibration.

We would suggest that this significant and underlying aspect has not been reflected adequately in the draft Code for the following reasons -

- The assertion that Miniature locomotives should be Double Insulated like house wiring is very dangerous.
- Miniature locomotives produce a lot more vibration than a house and the vibration must be mitigated.
- We have instituted triple insulation to give an extra level of safety.
- Best Practice would suggest that Multi-core cable must be used for all wiring,
- Also, Wiring should not be pulled tight anywhere as the vibration might stretch and break the cable.
- Extra caution should be exercised when cables are passed through metal sheet to make sure that sharp edges cannot cut into cabling.

2. Earth v. Chassis

Miniature railways are built with a number of track standards.

Metal sleepers,
Wooden sleepers.
Plastic sleepers.

On top of the track, there are a number of differing signalling systems, some of which rely on the track construction NOT to be earthed..

All of these factors conspire to separate a railway engine from earth.

For practicality it is best to refer to any common point as “**chassis**”.
In a railway engine, this is the only common point that can be relied upon.

3. Residual Current Devices

We have concern with respect to “**earth leakage devices**” or more commonly referred to as “Residual Current Devices” (RCD's).

Residual current devices are used in the home and the workplace to protect people from electric shock. RCD's are designed to work at 50Hz in Australia and are not designed to work at any other frequency than the frequency that they were designed to run.

<https://www.captech.com.au/2016/05/18/is-your-mining-application-earth-leakage-relay-vsd-suitable/>

4. Variable Frequency Drive

Any non-fixed speed generation plant is by nature a variable frequency generator. Diesel electric railway engines, large and small fall under this category.

The only locomotive running at DVR and to our knowledge, the only one running in Australia under this code, has the following specs:-

VFD = Variable Frequency Drive

Alternator frequency 20 to 60Hz (RCD's will not work),

VFD output frequency zero to 400Hz (RCD's will not work).

We would explain that VFD's are not sine wave output devices, they are a square wave representation of a sine wave. RCD's have trouble with the square waves as they tend to unbalance the phase currents, initiating RCD dropouts.

6.10

3 phase systems have had colour codes for the 3 phases since its inception, we see no benefit in making traction wiring orange.

Section 4: SCOPE

4.9

Under this clause there is mention of other risks.

We would raise the aspect of people with **Heart Pacemakers**.

Heart pacemakers are sensitive to Electromagnetic radiation.

Any generator, alternator, dc traction motor or AC traction motor gives off Electromagnetic radiation.

To this end we have spoken to:-

<https://www.adelaidecardiology.com.au/for-patients/cardiac-devices-remote-monitoring/cardiac-device-manufacturers>

They suggest that 1 meter is a safe distance from any motor device generating Electromagnetic radiation