MV Technology Solutions

Safe Switching for Railway Tunnels

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Safety in Tunnels

Why is Safety more of a concern inside the Tunnel?

By being in a closed area, railway tunnels present a **higher risk** for the safety of train passengers, onboard staff and general maintenance crews during both operations and even tunnel closures. Fire, gas leaks, smoke, derailment, long stops and other accidents require **preventive safety measures** to minimise the risk and increase the comfort of passengers. When it comes to switching, there should be no arcing in tunnels.

How can these risks be mitigated?

There are many methods and technologies available to mitigate some of these risks in rail tunnels.

The management of safety in tunnels has an impact on nearly all aspects of the rail infrastructure. The promotion of safety in tunnels is often covered through different activities, from tunnels planning and building (e.g. new construction materials and techniques, lights, ventilation and all other components having an influence on tunnel safety) to prevention, mitigation, evacuation and rescue procedures.

Sometimes the once thought as most suitably chosen technologies may not actually be the most suitable and may in fact not be the **safest option** available.

What if we could significantly reduce some of these risks, by **the best from of risk management – elimination?**

Safer alternative to GIS for Catenary Switching

Utilising existing proven technology?

Eliminate the unnecessary risk associated with gas equipment within tunnels, which increases the potential for gas leaks, and heightened probability for fire or explosion.

In some applications there can be somewhat advantages to considering GIS, as its generally considered to be more compact than AIS as its expected to require more space to extinguish the arc. However using proven equipment, already in use throughout QueenslandRail networks, we can utilize the same Vacuum technology found in our pole top load break switches, in a purpose-built switchgear panel – **providing a safe, compact, and arc-free solution**.

For Tunnel Switching it is important to provide;

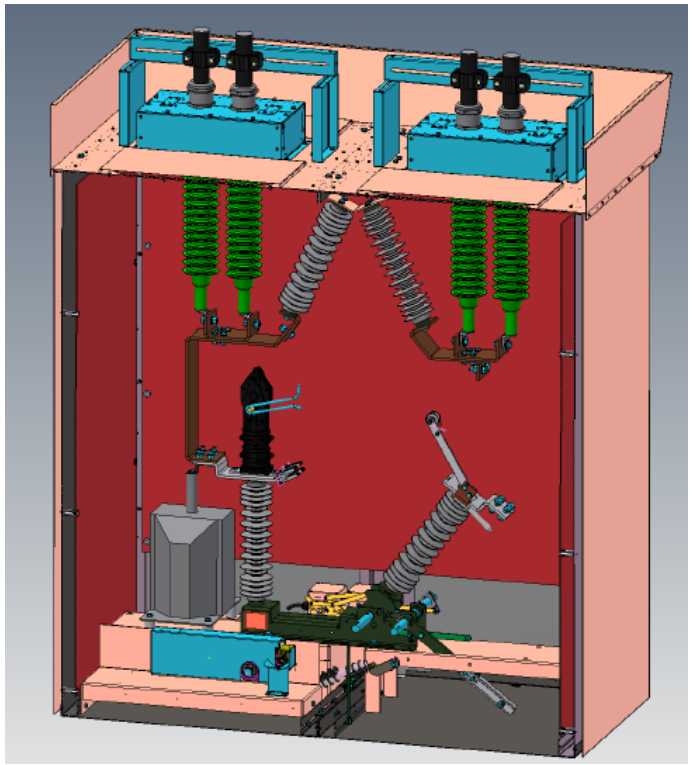
- **No Arcing** is permitted inside tunnels
  - Opening/Closing of Switches within Vacuum Chamber
- **Compact design**
  - Very limited space in tunnel substations, footprint should not exceed existing GIS panels.
- **High reliability**
  - Due to the difficulty carrying out maintenance inside rail tunnels
- **No risk of SF6 gas leaks**
  - Safer, air-insulated switchgear, removes any detrimental outcomes SF6 could create.
- **Clear Visual Confirmation of Switch position**
  - Window on panel enables operators to visually confirm switch operation and position
- **Completely safe cubicle** to meet safety regulations
  - Panel can be touched, doors opened, operated manually by hand crank etc.

Using the same proven highly reliable 25kV load break switch (Fla 15/97) switch and motor operation used with Australian AC rail operators

The Solution – Enclosed 25kV AC Load Break Switch

The lower lifecycle cost alternative?

The enclosed 25kV AC Vacuum Load Break Switch, utilizes safe advanced vacuum technology, with high reliability. Not only does it allow for Quick and Easy Installation, it also provides the minimum whole of lifecycle cost when compared to other equipment. Even considering the upfront installation costs, when ongoing maintenance, site visits and unnecessary repairs are taken into consideration, this quickly becomes not only the safest, but the best value option.



Load Break Switch (FLa 15/97), and Earth Switch:

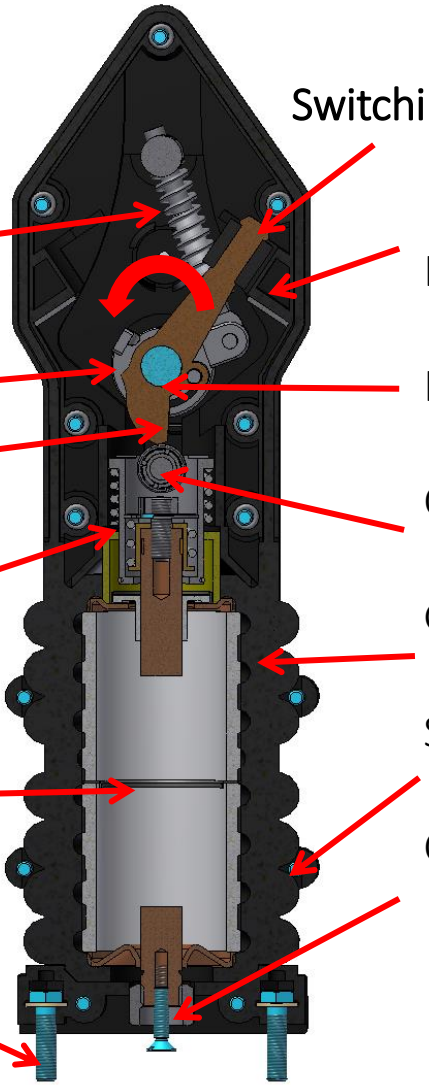
- 25kV Vacuum Load Break Switch can make/break load (1250A, 2000A available) and has a making capability of 16kA.
- Optional Earth Switch, can be operated by an additional motor drive.

Designed for **Reliability** and **Low Maintenance**

- Driescher's vertically operated switches are designed for reliability and have an operational lifetime of 10,000 mechanical switching cycles, with minimal maintenance.
    - Only an annual visual inspection is required for the offered units – virtually maintenance-free.
    - Recommended maintenance of the indoor motor drive is to be carried out after ten years at the latest or after 5,000 respective switching operations

Successfully used in the Crossrail Tunnel (Queen Elizabeth Line, United Kingdom) – chosen for its higher safety factors and reliability.

Arc Extinguishing Vacuum Bottle Switching Chamber



Switching chamber in ON

Switch spring

Indexing mechanism

Excenter

Spring cup with contact pressure springs

Vacuum-tube

Fastening screw
(connection to the contact plate)

Insulation material housing

Indexing shaft with shifter fork

Contact roller bearing

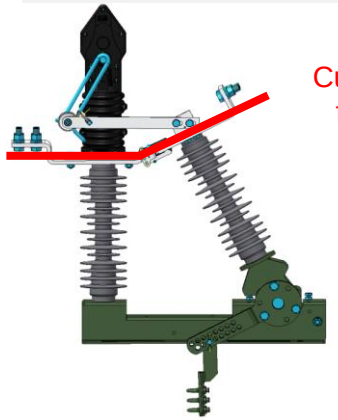
Gasket

Screw connection

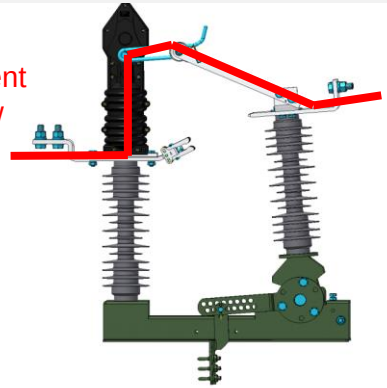
Contact nut

Functional Principle of Switching

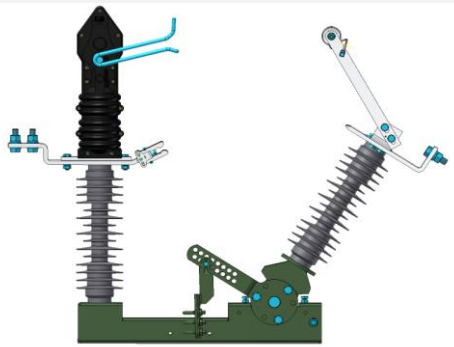
OFF-operation - While switching OFF (via the switching chamber) **no external arc is visible**



Switch disconnector
CLOSED

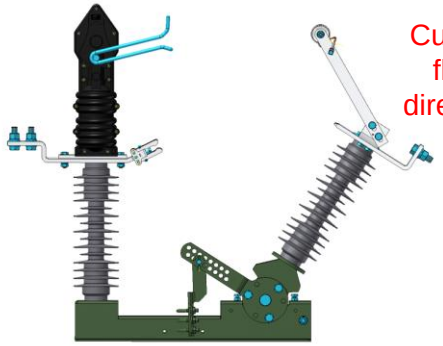


Switching point **OFF**;
Main contacts already **OPEN**;
current flow direction via the switching chamber (shunt circuit)

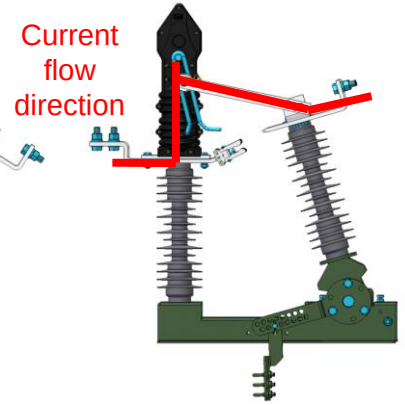


Switch disconnector
OPEN

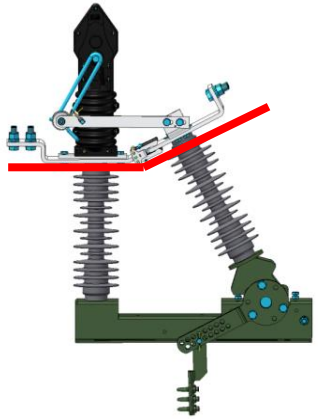
ON-operation - While switching ON (via the switching chamber) **no external arc is visible**



Switch disconnector
OPEN



Switching point **ON**;
Main contacts still **OPEN**; current flow
direction via the switching chamber (shunt circuit)

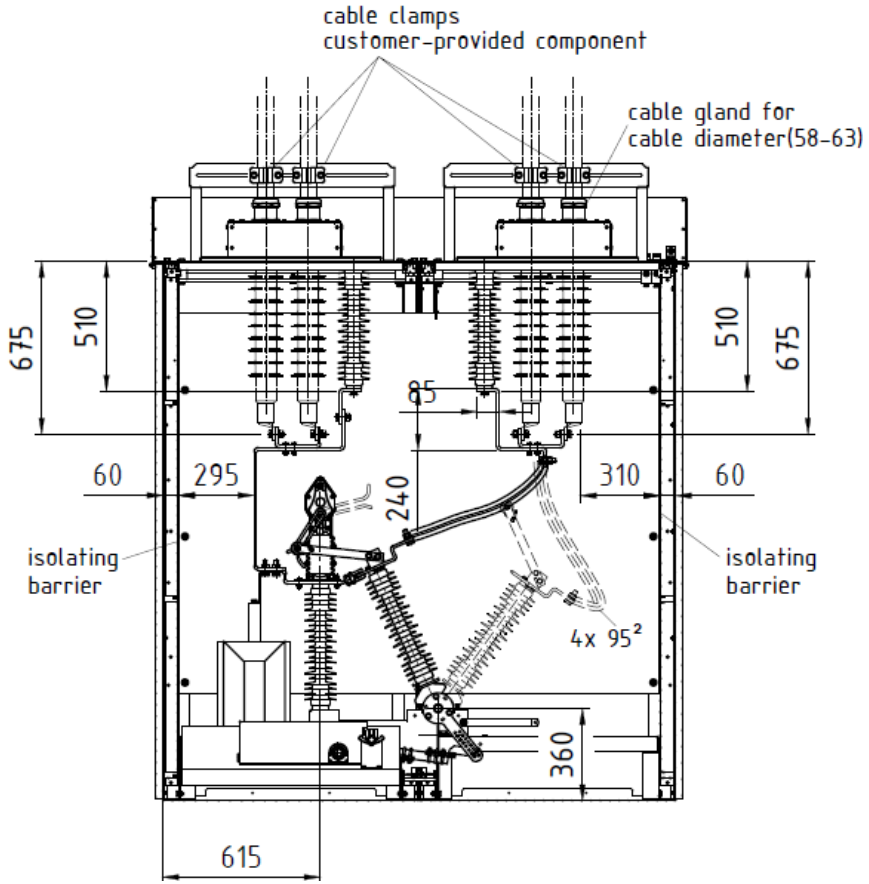


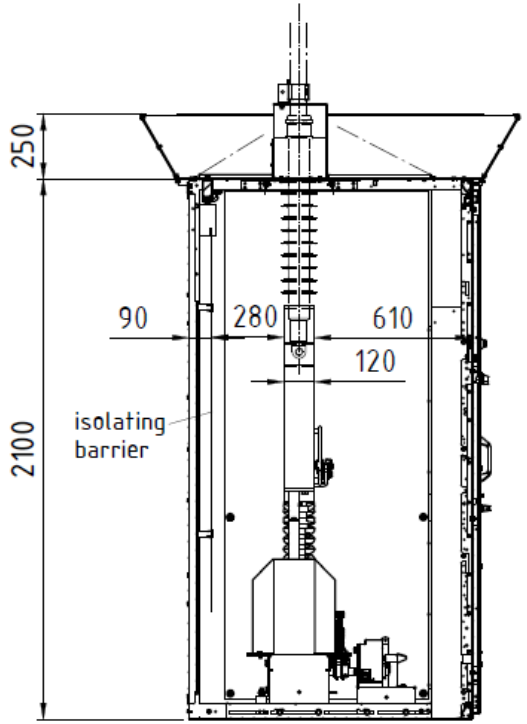
Switch disconnector
CLOSED

The Solution as used in Crossrail Tunnel, London

- Enclosed 25kV Vacuum Load Break Switch
  - Safe advanced vacuum technology, with high reliability
  - Quick and Easy Installation
  - Minimum whole of lifecycle cost

Safely Switch in Rail Tunnels
Reliably, and with Visual confirmation



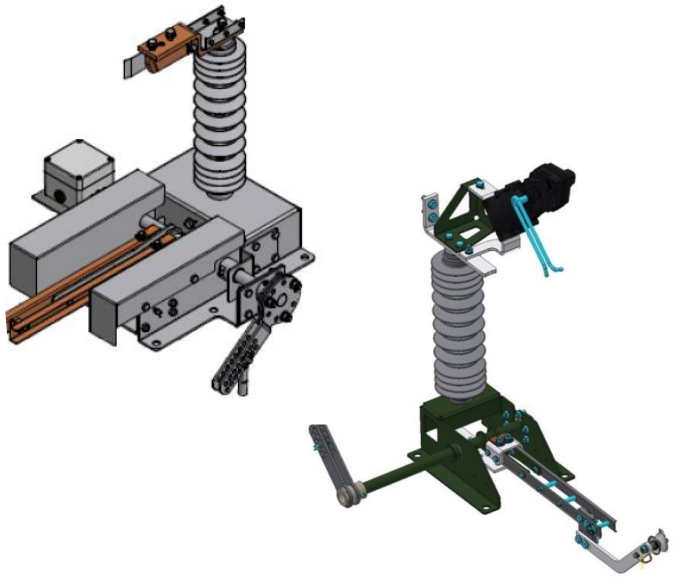


Alternative - Fast Safety Earth Switch for Tunnels

Why would you need a Fast Making Earth Switch (100kA)?

In the event of a fault or an accident in the tunnel, rescue teams cannot immediately enter until they know it is safe. As it is possible that live lines could be on the track, ground, or on the train.

Having access to a Fast Making Earth Switch (Emergency Earthing Switch) will allow safety and rescue crews the capability to immediately switch ON this earthing switch in front of the tunnel and can safely enter without concern for live wires. Usually installed at tunnel entry and exit points.



Making capability of 100 kA

Switch ON to energized catenaries

THANK YOU.

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