

# ENGINEERING SERVICES

## Network expertise



# GENERAL INFORMATION

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In the field of DC transport systems more than anywhere else, providing an adapted, efficient and safe product is a key factor. With millions of everyday users, installations must have the highest standards of reliability and security.

Due to our long experience in DC traction domain, Sécheron has developed an excellent knowledge and understanding of DC system design.



Today, Sécheron can offer a large range of services for DC traction network design and simulation in order to ensure the correct design and protection of the system.

It is essential to understand all the subsystems of a traction network such as the AC network interface, DC power supply substations, DC network and vehicles, and our engineering team does this successfully and effectively.

Available for clients looking to establish or to improve existing equipment or services, Sécheron is able to apply its extensive professional experience to a variety of situations.

Our offer includes a wide range of services from dynamic network simulation to measurement on-site and in the laboratory, through various calculations and tests on transformer-rectifier sets and short-circuits.

We offer consulting expertise and are able to answer any questions you may have about DC traction network design and calculation.

## MAIN BENEFITS

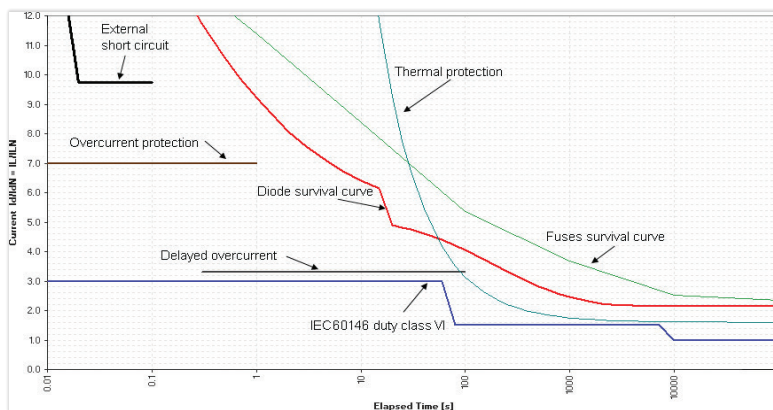
- ✓ Optimisation of DC electrical network for vehicle power supply and energy recovery
- ✓ Support for strategic decision analysis for railway infrastructure
- ✓ Precise results from simulation to fine-tune DC protection
- ✓ High knowledge for setting DC protection parameters
- ✓ Quick technical support and complex analysis assistance

# TRANSFORMER-RECTIFIER UNIT IN-LINE TEST

Sécheron has provided transformer-rectifier units for many years. Our experience in this domain has allowed us to develop specific software for the design of the transformer and rectifier more accurately and efficiently.

We are able to answer questions regarding transformer-rectifier units and their operation within the traction system.

Sécheron has a strong experience in leading combined tests of transformer-rectifier units according to IEC 62590, EN 50327 and IEEE 1653.2 standards in major test laboratories (CESI, IPH, KEMA and Powertech).



Protection coordination of a transformer-rectifier group

## STANDARDS

- **IEC 62590 (EN 50328)** | Railway applications – Fixed installations – Electronic power converters for substations
- **IEC 60146-1** | Semiconductor converters – General requirements and line commutated converters
- **EN 50327** | Railway applications – Fixed installations – Harmonisation of the rated values for converter groups and tests on converter groups
- **EN 50329** | Railway applications – Fixed installations – Traction transformers
- **IEEE C57.12.01** | Standard for General Requirements for Dry-Type Distribution and Power Transformers
- **IEEE 1653.2** | Uncontrolled Traction Power Rectifiers for Substation Applications Up to 1500 V DC Nominal Output

# DYNAMIC DC NETWORK SIMULATION

## SOFTWARE

For DC railway applications, a good knowledge and understanding of the entire system's behaviour is highly important.

It is fundamental to know if the electric system is capable to sustain the foreseen traffic.

To take into account the huge number of parameters and the complexity of the interaction between all parts of the system, Sécheron proposes a DC network simulation service relying on the innovative and proven Marcadet software developed by RATP.

With this software it is possible to analyse all kinds of networks, from simplest ones (one segment only) to complex ones (with a lot of branches, single/double track), and even with interconnections between each other (track interconnections or electrical links).

The simulation takes into account the foreseen service between different lines even with diverse headway and rolling stock.



## STUDIES

Sécheron has conducted various studies for different systems of railway (such as railways, light rail, metro, monorail, trolleybus, etc.) all over the world: Asia, Europe, Middle East, South America and Pacific.

As a manufacturer, Sécheron can complement these studies with advice on the selection of well adapted hardware and make propositions of actions to be done to fix problems and avoid critical situations.

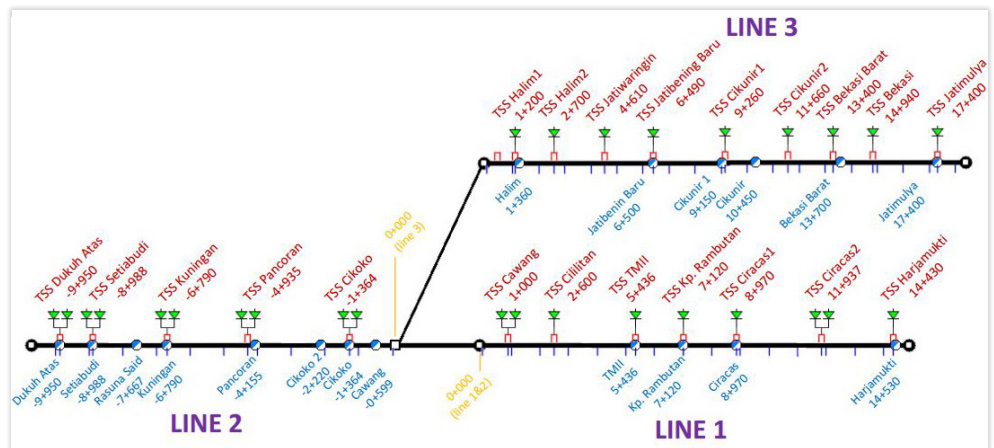
/// **Studies provided by Sécheron** can, among other things, answer the following questions:



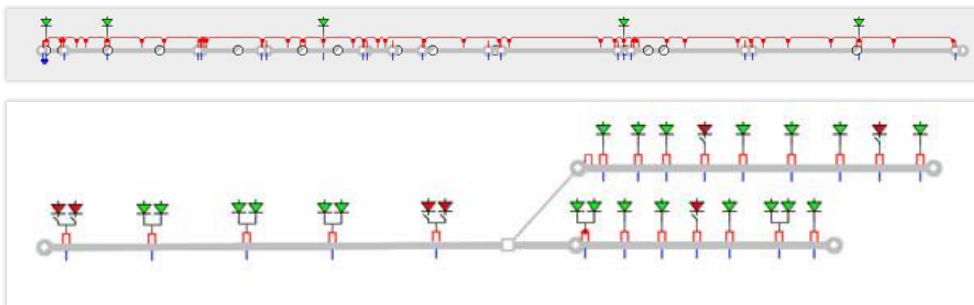
- Where to install the substations and how many?
- What power and which overload capability are required for the rectifier set?
- What rating shall be provided at each level of the feeding system (DC circuit breakers, disconnector switches, cables and catenary feeder, etc.)?
- What will be the voltage drop along the line?
- What happens in case of failure of one substation?
- What is the efficiency of the system and how can it be increased?
- What will be the negative rail to earth voltage along the track? Are VLD-O required and where?
- Is the installation of inverter relevant? Where and what power?



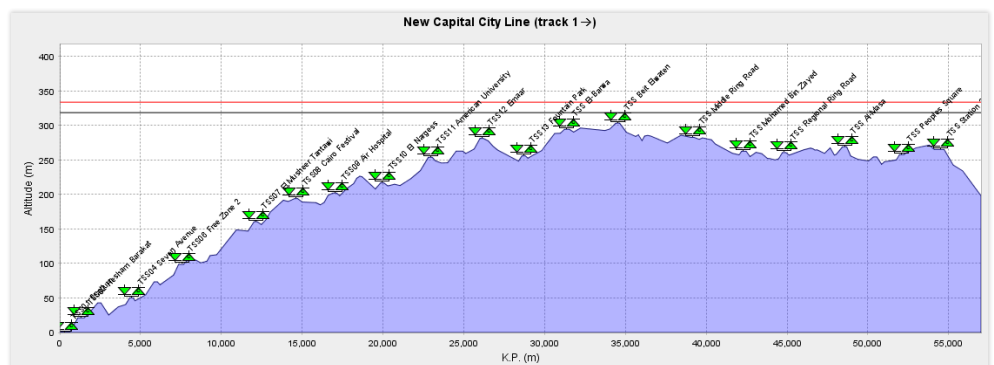
Services scheme



Rail network



Electrical diagrams of the line



Altimetric profile of the line

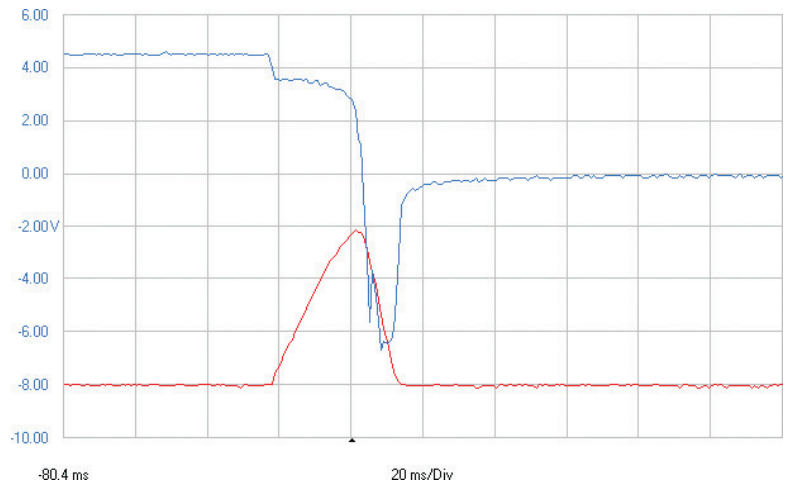
# SHORT-CIRCUIT AND ON-SITE TESTS

Sécheron, as a supplier of DC high-speed circuit breakers, has acquired a strong experience in the domain of short-circuits.

Theoretical knowledge and calculations complemented by on-site and laboratory testing (CESI Milano, IPH Berlin, Powertech Vancouver or KEMA Philadelphia) satisfy the demands of major transit authorities worldwide in terms of protection solutions.



**Field short-circuit test**  
Measurement of the voltage and the current during a short-circuit test



/// We are able to provide a **variety of services:**

- On-site short-circuit measuring in order to check the protection and their appropriate adjustment
- Short-circuit calculation in order to select the components in the electric distribution chain
- A complete study for the design and coordination of protection equipment (line fault di/dt, I<sub>max</sub>, thermal, etc.)
- Communicate to customer relevant information about rectifier capability to support him regarding the AC protection functions settings

**Field short-circuit test**  
using a short-circuiting device  
installed on a trolley



/// We are also able to provide **measurements and on-site tests:**

- Stray current calculation and measurement according to EN 50122-2 standard
- Train start measurement
- Load sharing with several transformer-rectifier units
- Harmonics calculation and measurement
- Earthing and bonding analysis
- Insulation measurement of ungrounded railway networks (specific applications such as trolleybus, monorail, etc.)
- Post-incident diagnosis

**Stray current measurement**





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