TECHNICAL PRESENTATION

VTS

Traction Power Systems
More than 140 years of history
KEY FIGURES

Private ownership

Sécheron Hasler Group delivers its **products and services** to all major rolling stock manufacturers, railway & mass transit operators, general contractors for fixed installations, and service partners **worldwide**.
COMPANY MISSION

- Provide Highly Reliable Systems and Components to serve the Rail Transit Industry
- Worldwide Presence
- Comply with IEEE and IEC
- Dual focus at component level and systems level
- Partner with major systems integrators for Rolling Stock and Wayside R&D applications.
- Significant R&D and Quality Assurance
- TPS Systems Group provides DC Engineered Solutions to Owners, Integrators, Packagers, and Integrating Contractors.
ELECTRICAL SAFETY SOLUTIONS

- DC circuit breakers
- AC circuit breakers
- AC & DC high-voltage integrated systems
- Contactors
- Disconnectors for rolling stock
- Disconnectors for fixed installation
- Earthing switches
- Traction measurement systems
- Current collectors
- Master controllers
- Wheel flange lubricators
- Engineering services
for Rail Vehicles &
DC Traction Power
Substations
BUSINESS OVERVIEW | TPS

TRACTION POWER SYSTEMS

- Rectifiers
- Inverters
- Reversible controlled converters
- High-speed circuit breaker panels
- Disconnect switch panels
- Load break switch panels
- Voltage limiting devices
- Current & voltage measurement
- Outdoor railway switches
- Control & protection relays
- Control command & local SCADA
- Stray current monitoring systems
- Intelligent operation & maintenance systems
- Engineering services
BUSINESS OVERVIEW

TRACTION POWER SYSTEMS

for Rail Transportation – Electrification
Close to you in more than 40 countries worldwide
Technical Objective: DC Voltage controlled over complete line

Technology: Double or reversible converter composed by a thyristor rectifier and an IGBT inverter

Standard: IEC 62497, IEC 60146-1, IEC 60146-1, IEC 62590

Approach: Completely independent inversion and rectification functions.

Quantity: 14 Units

Supplier Challenge: Client provided high standard of performance and very specific design requirements.

Designer of Record: Specified by LTA, Designed & Manufactured by Sécheron
Technical Objective: Heat avoidance in tunnel application with no breaking resistors.

Technology: High power high overload thyristor inverter (2 MW with 500 % overload @ 750 V)

Standard: IEC 62497, IEC 60146-1, IEC 62590

Approach: Transfer breaking energy into the systems to avert breaking heating load in tunnel.

Quantity: 54 Units

Supplier Challenge: High power design with natural air cooling as per customer specification.

Designer of Record: Specified by MHI, Designed & Manufactured by Sécheron
CADIZ, SPAIN: IGBT BASED INVERTER

- Technical Objective: Optimize energy recovery on existing tram line
- Technology: IGBT inverter
- Standard: IEC 62497, IEC 60146-2 , IEC 62590
- Approach: Prioritize efficient energy recovery with good power quality and unity power factor

- Quantity: 2
- Supplier Challenge: Limited space in traction substation, optimization of size and re-use of existing rectifier MV-CB, Installation and commissioning done in an existing line in service
- Designer of Record: Specified by Local Authority (Junta de Andalucía), Designed & Manufactured by Sécheron
Technical Objective: Control of voltage in the DC contact line under heavy overload conditions

Technology: Thyristor rectifier

Standard: IEEE 1653.2, IEEE 519

Approach: Prioritize overload capacity and system reliability

Quantity: 7

Supplier Challenge: Complex specification with high overload, stringent reactive power requirements, 6 pulse operation, high short circuit withstand

Designer of Record: Specified by VMR, Designed & Manufactured by Sécheron
Secheron delivered equipment for 2 metro lines, 1 more line will be delivered in 2024 for a total of 62 substations.

Secheron responsible for the maintenance of delivered equipment:
- In January 2022, 5-year contract sign for 29 TPSS
- Q2 2024, 33 TPSS will be added to the contract (Phase 2)
- Contract between Secheron Hasler India (SHIN) and Metro of Bangalore (BMRCL) directly

Sécheron’s scope is Design, Build and Maintain including deployment of IOMS

IOMS provided services, functions:
- Asset and Maintenance Management System
- Execute Operations to a reliability and up time performance metric
- Manage daily operations, scheduling, ordering, etc.
- Mobile app available (and used in India by owner’s operators and Secheron team)

Bangalore is the main reference of Indian heavy metro systems. IOMS was successfully implemented.
TRACTION POWER SYSTEMS

PRODUCTS & SOLUTIONS
Harmonization with traction-rectifier performance
Complete transformer-rectifier groups on request

Cast resin dry type transformers
Oil immersed type transformers
In-line tests in laboratory
- Open-circuit tests
- Load test
  - Current sharing
  - Voltage and load regulation
  - Temperature rise
- Measurement of harmonics
- Measurement of losses and calculation of efficiency factor
- Short-circuit test
Ideally sized and proven semi-conductors offering high performances and reliability

Components are fully interchangeable
Regulation of the voltage of the line in order to compensate voltage drops
Optimization of the operation in case of double converter
Inverter is designed to regenerate the braking energy to the distribution network. Saving up to 20% of the traction energy consumption.

- All voltages, up to 6MW

- Green energy for environmental care
- Renewable energy = savings
INV-I IGBT INVERTERS

- Designed to **regenerate** the braking energy to the distribution network
- Saving up to **20%** of the **traction energy consumption**

- With dedicated transformer

- With autotransformer
- Compact and robust design with long MTBF using presspack thyristor
- Cost efficient at high power

- Circuit in parallel

- Up to overload cycle class VII
System design and protection coordination with Sécheron switchgear to enhance reliability

Modular design, designed for easy maintenance
General characteristics of Reversible Controller Converter Unit

-3 x IdN  0  3 x IdN

Umin  Umin
800 V  700 V

Control area

Umax
900 V

Umax1

Voltage regulation range

Umax2

Rectifier output characteristic

α = 10°

α = 24°
Sécheron BOOST solution is a reversible system combining reliable diode rectifiers and IGBT inverter.

- Complete control over the traction power substations
- Enhanced power factor
- Decreased harmonics
- Reduced transformer power

12-pulse

6-pulse
The BOOST converter injects reactive power to compensate the reactive power naturally absorbed by the diode rectifier-transformer group, thereby reducing the line current.
By adjusting the reactive power injected on the AC side, it is possible to regulate the rectifier characteristic and thus obtain an ideal "flat" behaviour on the DC side.

This is achieved by compensating not only for the inductive voltage drop of the transformer, but also for the voltage drop caused by the rectifier diodes.

Meanwhile, the energy recovery function is also maintained, the system automatically transitions from recovery mode to BOOST mode without any maneuver or change to the circuit.

The required inverter to rectifier power ratio is approximately of 1 to 3, which is typical for energy recovery systems.

Note that for this to work in a TPSS with multiple rectifiers, the REV-BOOST system must be installed in all the rectifiers so that they maintain load sharing.
MAIN BENEFITS

- Energy recovery
- Voltage control, loss reduction in the DC line and increased train speed
- Independent rectifier and inverter modes
- Possible installation in existing traction power substations as an upgrade
- Increase of distance between traction power substations
- Improved power factor in medium voltage network
- Reduction of transformer power
- Reduction of no-load voltage in the DC line
- Based on well-known technologies
MBS HIGH-SPEED CIRCUIT BREAKER PANELS

MBS–Heavy Duty

Service & test positions

Development based on Sécheron’s experience of tractions systems and customer needs
Key components of the switchgear are Sécheron’s own products

- SEPCOS: Control & protection relay
- SEPCOS Display: Touch screen interface
- VM10 / VM12: Voltage measuring amplifier
- MIU10: Current measuring amplifier
- Optional SWS: Disconnector
- UR26 to UR80: High-speed circuit breaker
MBS–HD

- **Heavy Duty** performances
- Fully type tested according to **IEEE Std. C37.20.1-2015** and **C37.14-2015**
- Meet all applicable **Buy America Act** requirements
Ensuring protection of person according to voltage limits defined in EN 50122-1

Negative-earth protection and monitoring for systems up to 3.6 kV
50 years of experience in control & protection relays

1970 DDL E23
1980 DDL DBC120 DDR
1990 PCU 6000 SEDEL
2000 SEPCOS
2006 SEPCOS NG & Display
2008 PCU NG SEPCOS PRO S
2012 SEPCOS & Display
2020 SEPCOS-PRISM

SEPCOS DC CONTROL & PROTECTION RELAYS
- High-tech equipment that satisfies the most demanding safety requirements applicable to DC electrical power systems
- A powerful electronic system based on several microprocessors
Modular product according to each project needs

SEPCOS BASIC

SEPCOS COMPACT

SEPCOS PLC

SEPCOS GATEWAY
SCMS STRAY CURRENT MONITORING SYSTEMS

- Monitoring of stray currents based on rail potentials measurements
- Designed to limit corrosion of metallic structure
- Recommended according to EN50122-2:2011 standard
Collect of potential between return rail and earth via VLD’s located all along the track.

Transmission of collected data from the SCD to the central unit via communication.

The central unit archives, analyses and depicts the potential of the tracks via an executable HMI interface.
- Decrease physical human service intervention inside a traction power substation energized environment
- Expand traction power substation life time
- Run on cloud based server or in a local PC under the customer premises
Predict maintenance time frame
- Geo-localize potential faults
- Produce complete & detailed incident reports
- Statistical fault analysis
- Customizable dashboard (alarms, power consumption...)
- Easy and Automatic scheduling (Calendar, Gantt view)
- Automatically add periodic maintenance actions, sort action per type (breakdown, routine, planned...)
- Job card, power block and team assignment
IOMS HIGH LEVEL ARCHITECTURE

SCADA

Cloud based single connection

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TRACTION POWER SYSTEMS

TAILOR MADE SOLUTIONS
RATP: **DVS cubicles**

Type tested according to IEC Standards and customer specification
Seattle: **Tie breaker cubicles**

Type tested according to ANSI C37.20.1 Standards
TAILOR MADE SOLUTIONS

Caen Tramway – France

Replacement of 18 x SITRAS protection relays from Siemens + Current & voltage transducers due to obsolescence issue (Control of Sécheron breakers)

Before retrofit

After retrofit
TAILOR MADE SOLUTIONS

Yarra Trams Melbourne - Australia

- Retrofit of 17 feeder breaker cubicles located in 3 TPS – Complete trolley retrofit (Replacement of AEG breaker by UR / Omron protection relays / Additional LTD device)

Before retrofit

After retrofit
Jakarta Kommuter Train – Indonesia
Meiden HSCB trolley replacement (UR36-82s - 3600A / 1500V)
NETWORK EXPERTISE

- Dynamic DC network and train simulation
- Wide range of services from dynamic network simulation to measurement on-site and laboratory
- Protection coordination of a transformer-rectifier unit
- Short-circuit and on-site tests
REFERENCES
References in 273 cities and 60 countries
WHAT MAKES US UNIQUE

Wide range of top quality products

System service expertise
(system study, transformer group, SCMS, local SCADA)

World leader in DC field

Strong local support & local expertise
THANK YOU FOR YOUR ATTENTION