Energy and Digital World (EDW) 2024
Sustainable Mobility & Railways Electrification Solutions

Sushobhan Saha Roy – Transport Segment Manager, Hub Asia, Grid Integration

2024-06-14

Hitachi Energy

About Hitachi Energy

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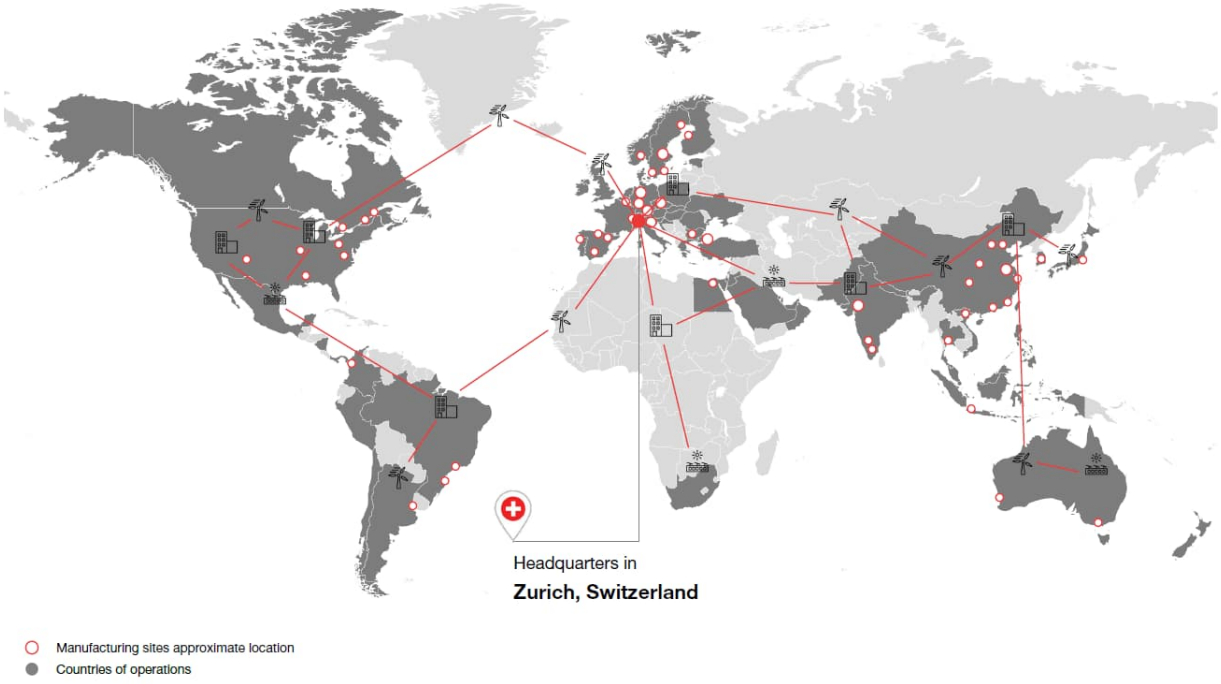

~45,000 employees

90 countries with 200+ offices

~250 years' heritage combined

1,800+ field engineers

2,400 R&D experts

~ $13 billion USD business volumes

Four Business Units

Grid Automation	**High Voltage Products**
Grid Integration	**Transformers**

Customers

- Transport & Infrastructure
- Industry
- Utilities

Offering

- Services
- Software & Automation
- Systems
- Products

Geographies

- Asia, Middle East & Africa
- Americas
- Europe

% split based on FY 2023 orders

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Hitachi Energy – Technology and market leader across all business units

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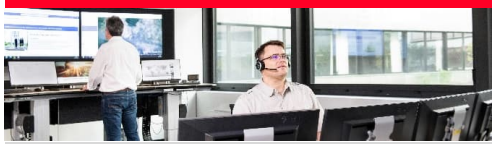
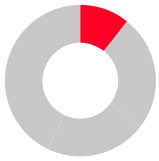
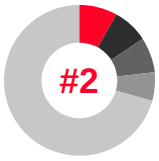
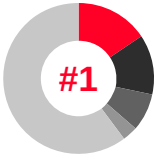
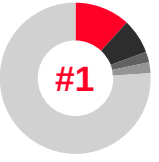
Grid Automation (GA)	Grid Integration (GI)	High Voltage Products (HV)	Transformers (TR)
			
Supporting 50% of the top 250 global electric utilities	Global leader in HVDC[2] >150 GW[3] of HVDC links integrated into the power system	Installed 1 out of 4 high-voltage switchgear in the world	Global leader across complete range of transformers, components & services
Leading Grid Edge references & > 6,000 MW[1] grid integrated (including eks Energy)	4,000+ power quality systems operating globally, across 50+ countries	>500k high-voltage circuit-breakers installed globally	From distribution up to UHV[5] 1,200 kV AC[6] & 1,100 kV DC[7]
Facilitates US$ 68B+ of wholesale market trades annually	~15,000 systems operating globally, across 50+ countries	Leading EconiQ SF_6 –free high-voltage product portfolio	World's largest installed base and largest portfolio/applications
 Revenues	 Revenues	 Revenues	 Revenues
 Market share	 Market share[4]	 Market share	 Market share

Driving innovation, pioneering digital technologies and leveraging the world's largest installed base for service opportunities

[1]Megawatt [2]High Voltage Direct Current [3]Gigawatt [4]In power conversion technologies [5]Ultra-High Voltage [6]Alternating Current [5]Direct Current
BU market share based on internal estimates on unconsolidated market – indicative; BU FY2023 revenues

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Hub Asia, Grid Integration | Overview

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Installed base

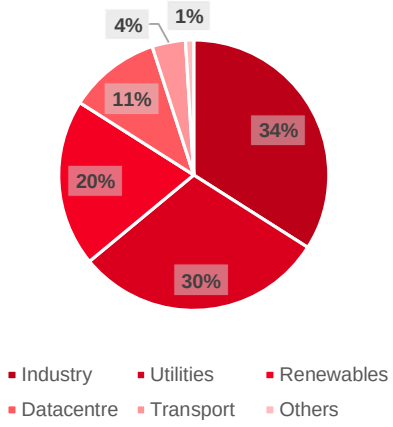
600
Employees

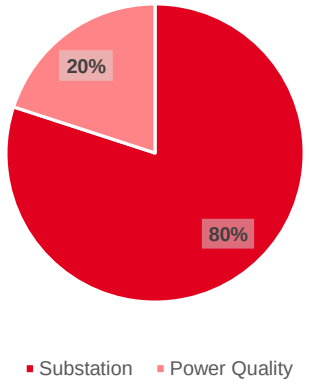
200
Projects

10
OUs/PSOs

23
Countries

Customers





Business Volume

>350 M$
Revenue

HSE & Sustainability

Fossil-free electricity
in HE operations in 2022

Safety Programs
Life Saving Rules
Hub Asia HSE program to support zero harm

- OU – Operating Unit
- PSO – Project Service Office
- "Customers" data based on FY22
- "Employees", "Projects", and "Revenue" numbers provided by Norbert Rambuszek (Hub Asia, GI Controller)
- "HSE and Sustainability" data provided by SiongPeng Ho (Health, Safety, and Environment Manager)

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Markets we serve

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Utilities

Partnering with utilities for ~130 years from generation, to transmission and distribution

Renewables

Accelerating renewable integration with strong installed base

Industries

Supporting industrial customers to electrify the entire energy value chain

Transportation

Enabling society to meet sustainable mobility demands in air, land, water and rail

Data centers

Providing the data center industry with reliable power connection and eco-efficient solutions

Smart Life

Advancing sustainable energy for industry and society with solutions that reduce waste and CO_2 footprint

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Rail Portfolio

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Reliable power from the grid to the wheel

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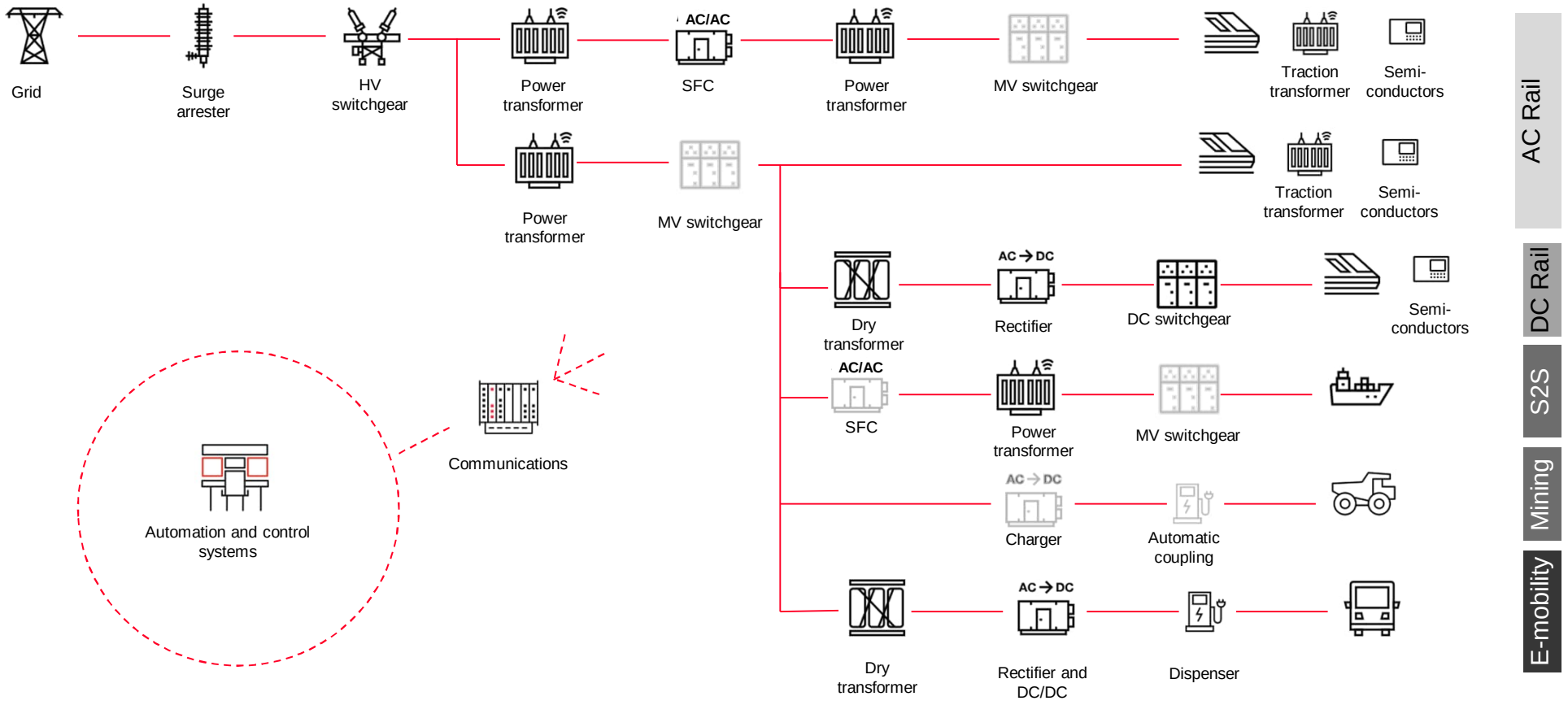

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Rail and urban transport electrification

What we offer

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Power supply portfolio for rail and urban transportation:

- AC and DC traction substations including switchgear, transformers, protection and control equipment
- Static Frequency Converter (SFC) stations
- Power quality systems
- Network management and SCADA systems
- Energy recuperation and wayside storage systems
- Interface management, requirement management
- E-mobility solution – TOSA flash charging bus technology
- Dynamic traction power supply simulations based on powerful software tools
- System studies (earthing and bonding, EMC, harmonics, insulation coordination, RAM, functional safety)
- Depots and workshops supplies
- Power system modelling

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Rail and urban transport electrification

Value-added system integration

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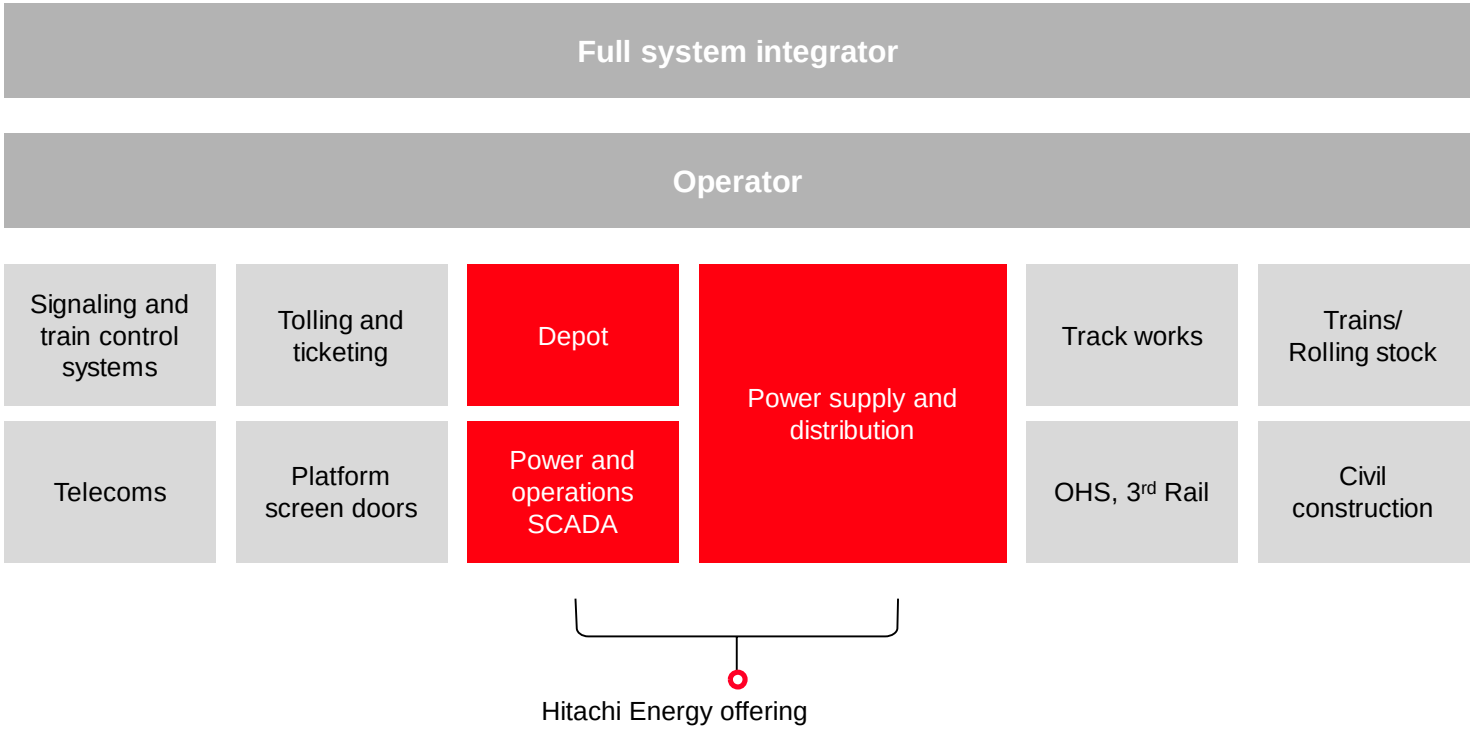
The portfolio for traction power supply systems covers:

- Consulting services, such as system studies and traction power simulations
- Traction substations for AC and DC applications; complete electrification projects
- DC traction substations; wayside energy storage systems
- FACTS (Flexible AC Transmission Systems) static frequency converter and load compensation equipment



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Rail and urban transport electrification

What we offer in AC

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Hitachi Energy offers a comprehensive range of AC traction substations for 16.7, 25, 50 or 60 Hz rail applications including regional railway networks, dedicated freight and high-speed lines, comprising:

- Single- or two-phase feeder substations
- Switching posts
- Autotransformer stations
- Substation automation (local control and protection) systems
- Engineered packages covering the complete scope from the grid connection to the overhead contact line

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Rail and urban transport electrification

What we offer in DC

Hitachi Energy is also an experienced partner for DC traction substations for all types of applications including urban transport systems, suburban and mainline railways, covering the standard traction voltages of 750V DC, 1500V DC and 3000V DC.

The Hitachi Energy portfolio covers complete substation packages including:

- DC switchgear
- Transformers
- Rectifiers
- Substation automation
- Control and protection systems
- Stray Current Monitoring Systems
- Dynamic Braking Systems

COET IN TRACTION | OUR PRODUCTION

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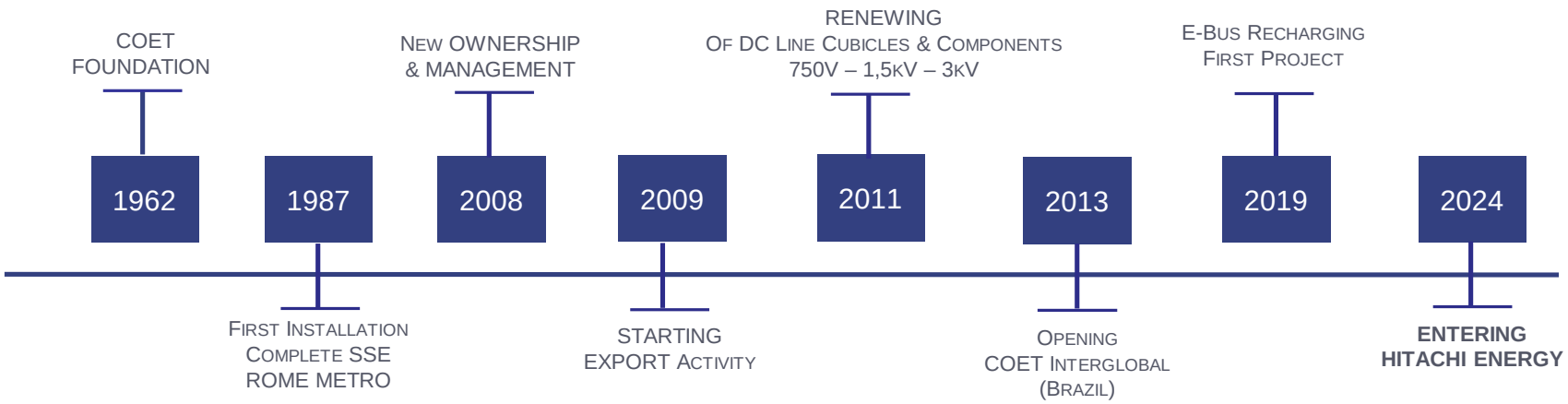
- Location: San Donato Milanese (Milan) Italy
- Employees: 99 (18 Engineers)
- Fields of activity: Dc Traction Substations
  Power Converters (e-Bus Recharging)
  Industry
- Facilities: 8200m^2 AREA
  4900m^2 PRODUCTION
  520m^2 OFFICES
  2 Testing Labs for LV & HV Tests



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PRODUCTS & SOLUTIONS

DC TRACTION CUBICLES

E-BUS RECHARGING SYSTEMS

INDOOR & OUTDOOR DC SWITCHES

ELECTRONIC DEVICE

APPLICATIONS

Railway

Metro & Tramway

E-Bus

Industrial

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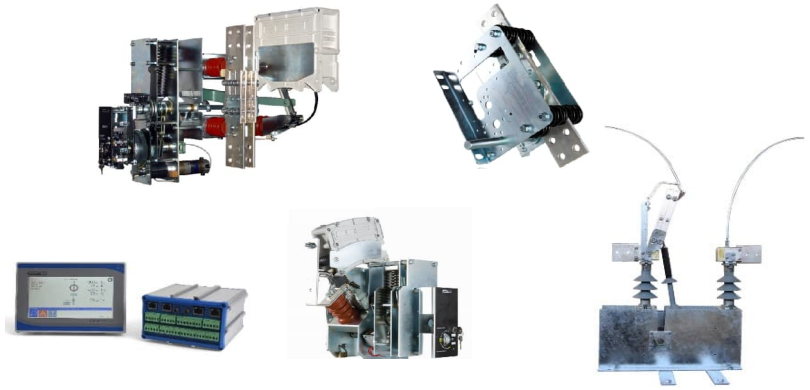
DC TRACTION PRODUCTS

- RECTIFIER CUBICLES
- FEEDER CUBICLES
- NEGATIVE PANELS
- DISCONNECTOR CUBICLES
- TRACK SIDE PANELS
- VOLTAGE LIMITING DEVICE
- LINE & EARTH DISCONNECTORS
- LOAD BREAK SWITCHES



APPLICATIONS:

RAILWAY:	3 - 3.3KV
METRO:	1,5KV
TRAMWAY:	750V
MONORAIL:	750V
TROLLEY BUS:	500V - 750V

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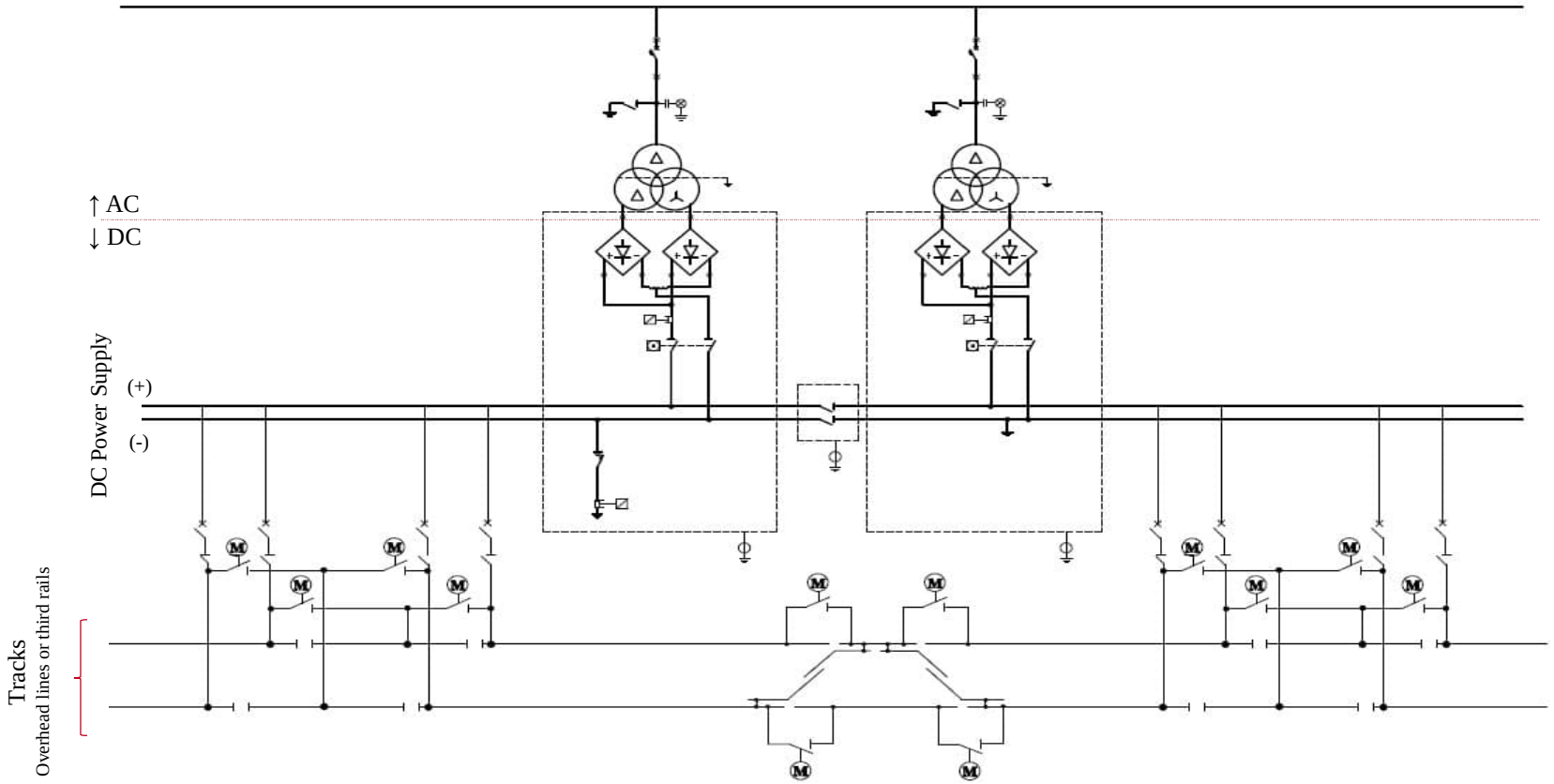
Typical Single Line Diagram of a Traction Substation



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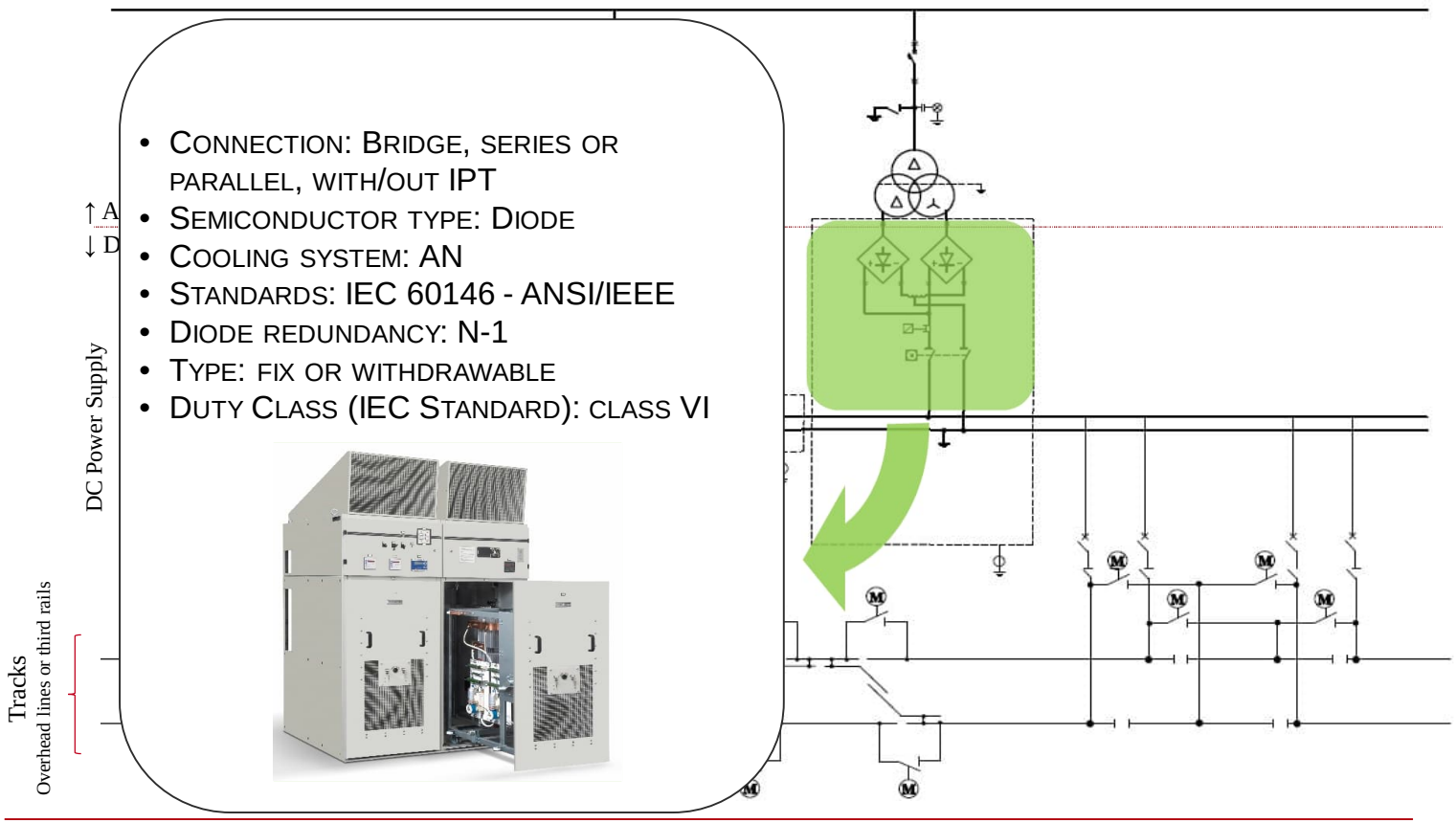
RECTIFIER CUBICLES

- CONNECTION: BRIDGE, SERIES OR PARALLEL, WITH/OUT IPT
- SEMICONDUCTOR TYPE: DIODE
- COOLING SYSTEM: AN
- STANDARDS: IEC 60146 - ANSI/IEEE
- DIODE REDUNDANCY: N-1
- TYPE: FIX OR WITHDRAWABLE
- DUTY CLASS (IEC STANDARD): CLASS VI



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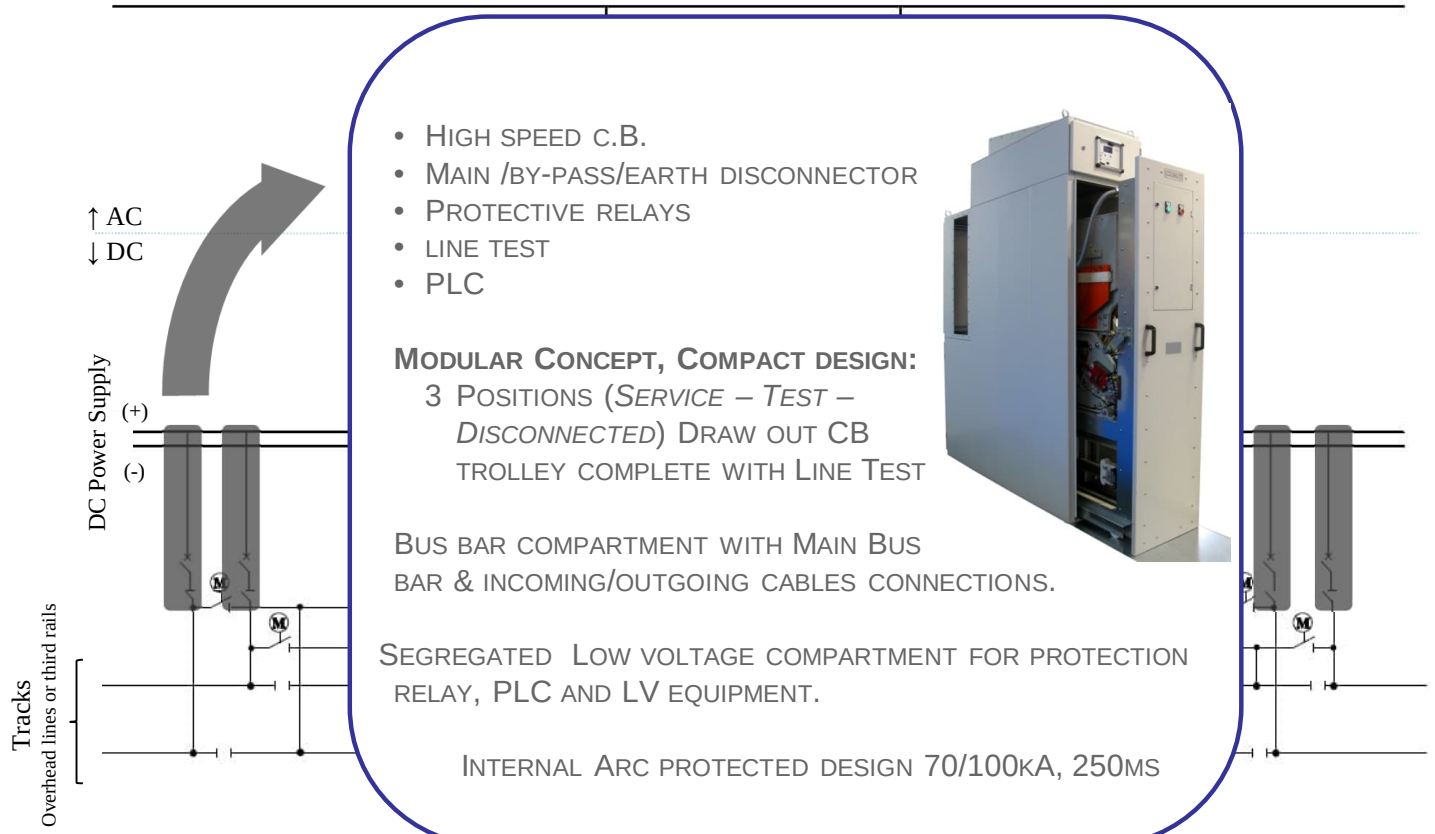
FEEDER CUBICLES



- HIGH SPEED C.B.
- MAIN /BY-PASS/EARTH DISCONNECTOR
- PROTECTIVE RELAYS
- LINE TEST
- PLC

MODULAR CONCEPT, COMPACT DESIGN:
3 POSITIONS (*SERVICE – TEST – DISCONNECTED*) DRAW OUT CB TROLLEY COMPLETE WITH LINE TEST

BUS BAR COMPARTMENT WITH MAIN BUS BAR & INCOMING/OUTGOING CABLES CONNECTIONS.

SEGREGATED LOW VOLTAGE COMPARTMENT FOR PROTECTION RELAY, PLC AND LV EQUIPMENT.

INTERNAL ARC PROTECTED DESIGN 70/100KA, 250MS

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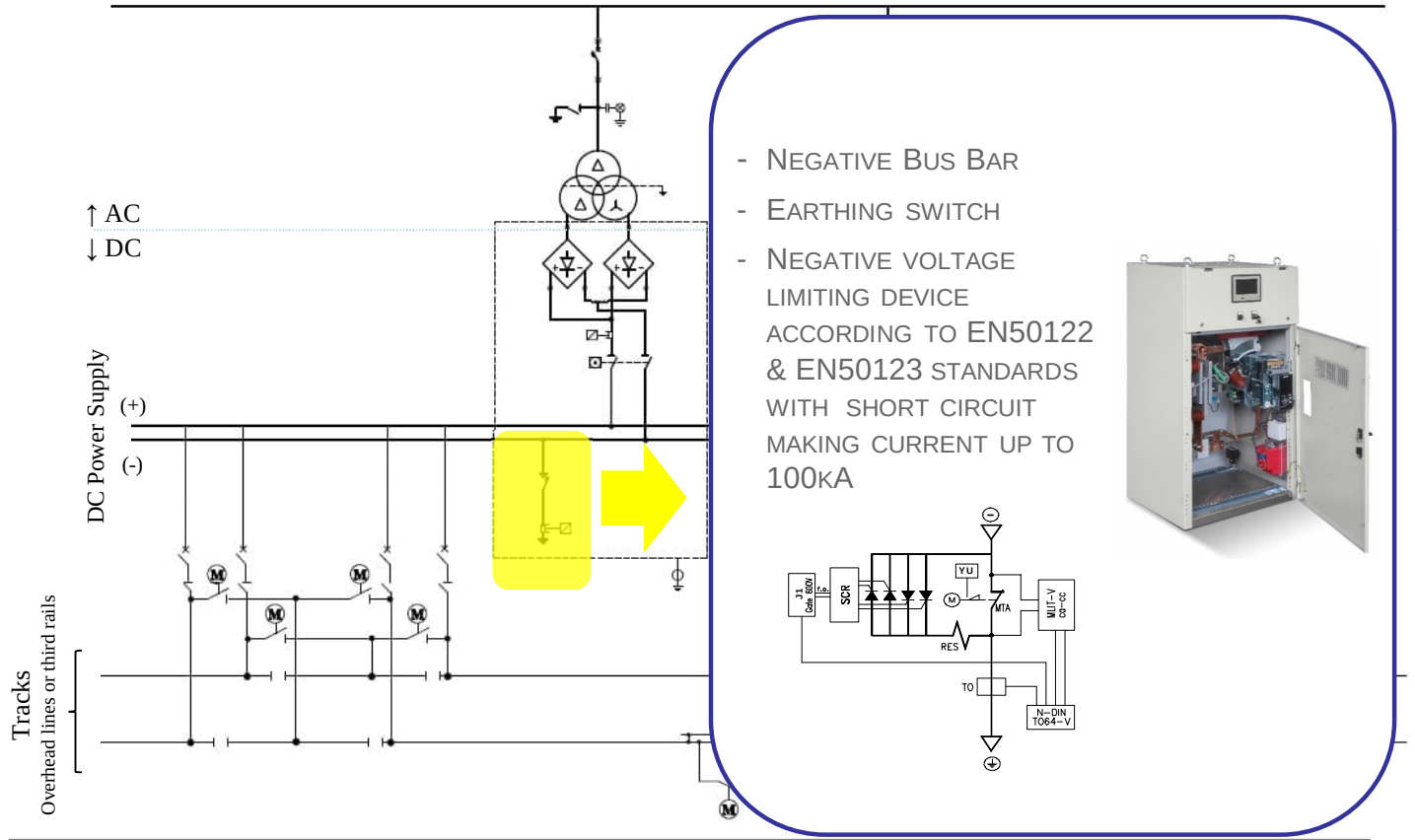
NEGATIVE CUBICLES with VLD



- NEGATIVE BUS BAR
- EARTHING SWITCH
- NEGATIVE VOLTAGE LIMITING DEVICE ACCORDING TO EN50122 & EN50123 STANDARDS WITH SHORT CIRCUIT MAKING CURRENT UP TO 100KA

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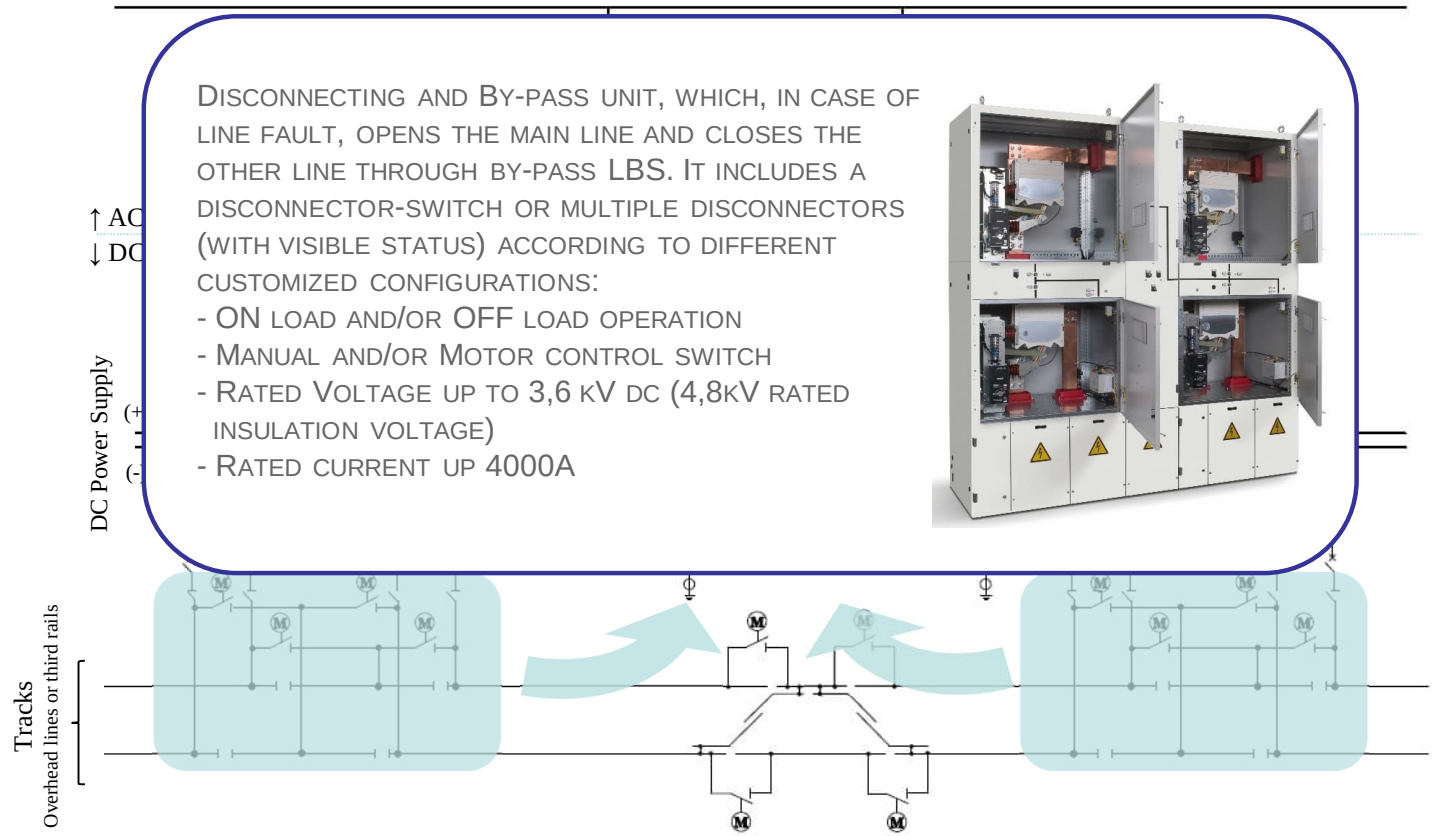
DISCONNECTOR CUBICLES

DISCONNECTING AND BY-PASS UNIT, WHICH, IN CASE OF LINE FAULT, OPENS THE MAIN LINE AND CLOSES THE OTHER LINE THROUGH BY-PASS LBS. IT INCLUDES A DISCONNECTOR-SWITCH OR MULTIPLE DISCONNECTORS (WITH VISIBLE STATUS) ACCORDING TO DIFFERENT CUSTOMIZED CONFIGURATIONS:

- ON LOAD AND/OR OFF LOAD OPERATION
- MANUAL AND/OR MOTOR CONTROL SWITCH
- RATED VOLTAGE UP TO 3,6 KV DC (4,8KV RATED INSULATION VOLTAGE)
- RATED CURRENT UP 4000A



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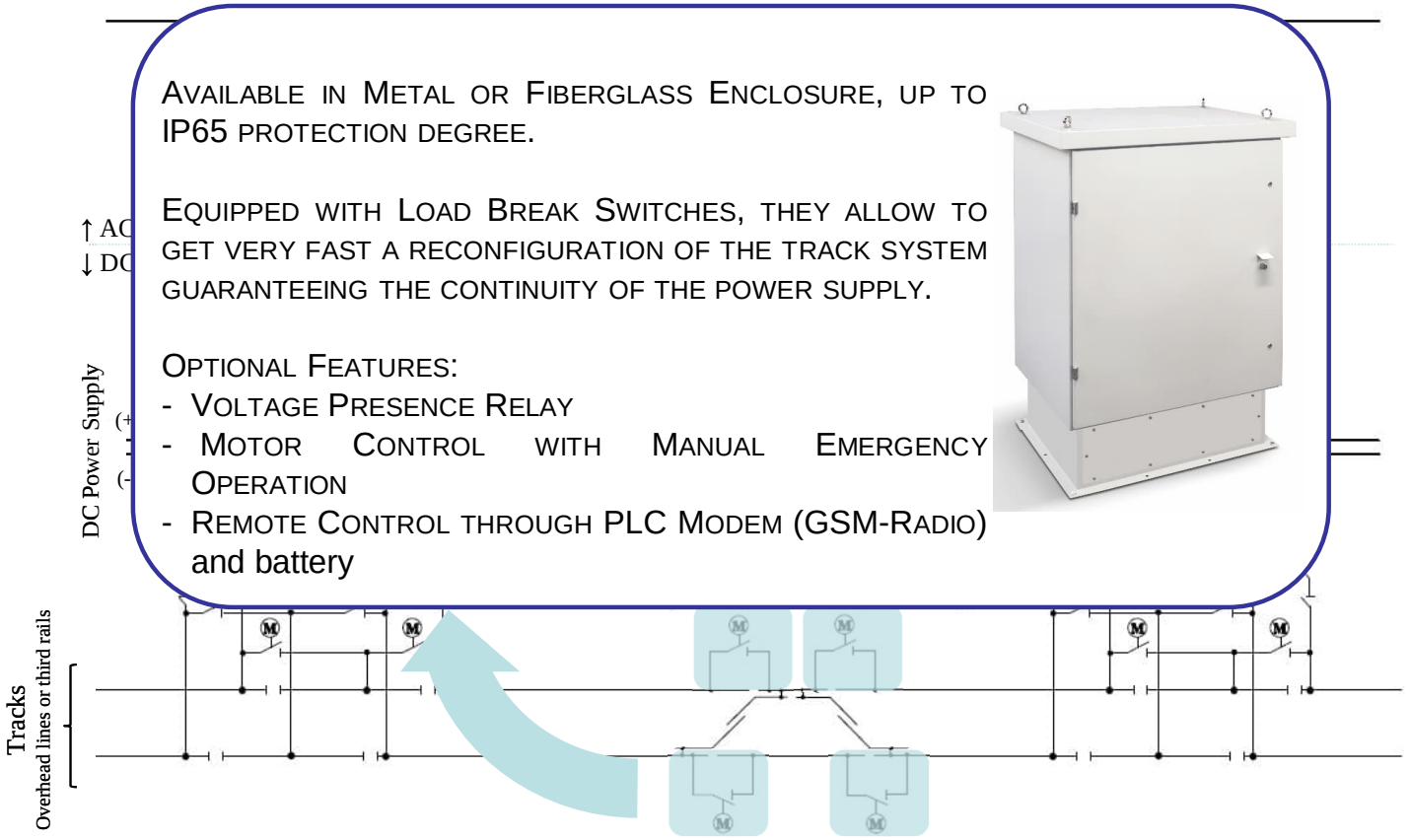
TRACK SIDE DISCONNECTING CUBICLES

AVAILABLE IN METAL OR FIBERGLASS ENCLOSURE, UP TO IP65 PROTECTION DEGREE.

EQUIPPED WITH LOAD BREAK SWITCHES, THEY ALLOW TO GET VERY FAST A RECONFIGURATION OF THE TRACK SYSTEM GUARANTEEING THE CONTINUITY OF THE POWER SUPPLY.

OPTIONAL FEATURES:

- VOLTAGE PRESENCE RELAY
- MOTOR CONTROL WITH MANUAL EMERGENCY OPERATION
- REMOTE CONTROL THROUGH PLC MODEM (GSM-RADIO) and battery



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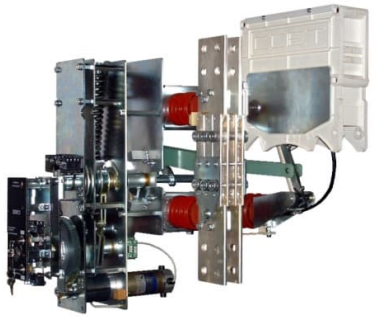
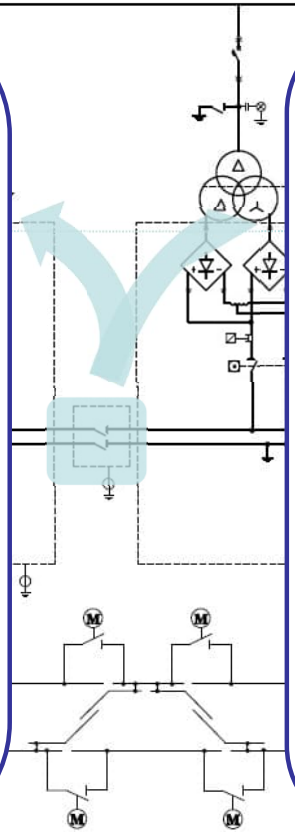
COMPONENTS FOR TRACTION APPLICATIONS

DISCONNECTORS AND LOAD BREAK SWITCHES FOR POSITIVE & NEGATIVE POLARITIES:

COET MANUFACTURES A COMPLETE LINE OF DISCONNECTORS AND LOAD BREAK SWITCHES DESIGNED ON PURPOSE FOR DC POWER SUPPLY SYSTEMS FOR TRACTION APPLICATIONS AVAILABLE AS LOOSE COMPONENTS OR HOUSED IN PANELS.





OVERHEAD LINE POLE MOUNTING LOAD BREAK SWITCHES:

COET MANUFACTURES A COMPLETE LINE OF OUTDOOR LOAD BREAK SWITCHES FOR POLE MOUNTING DIRECTLY CONNECTED TO THE OVERHEAD LINE OF A TRACTION SYSTEM.

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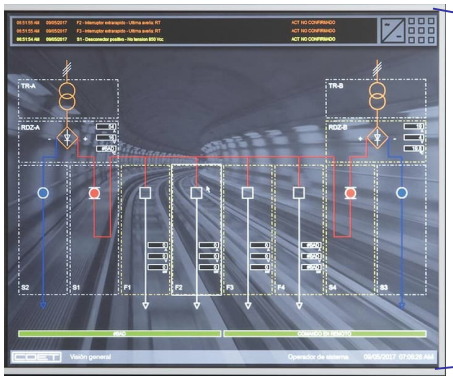
SCADA SYSTEMS



The device is equipped with:

- n° 7 output relays, for Trip and Signalling
- n° 1 output relay for diagnostic
- n° 16 Opto-isolated digital inputs
- n° 1 Ethernet port for HMI and/or Modbus TCP
- n° 1 Ethernet port for a communication by means of IEC61850 protocol (OPTIONAL)
- n° 1 Ethernet port for redundancy protocol (OPTIONAL)

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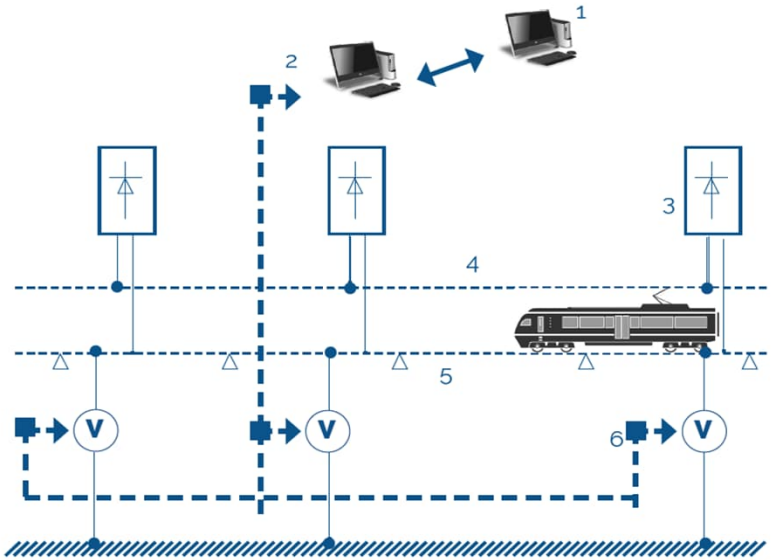
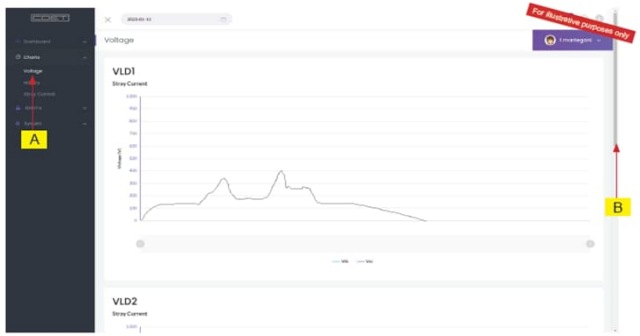
STRAY CURRENT MONITORING SYSTEMS



1 -SCADA system Sistema SCADA	4-Contact line Linea di contatto
2-Central evalution unit with SCV Software Unità di valutazione centrale con Softwa	5-Return circuit (track) Circuito di ritorno (binario)
3-Traction Substation Sottostazione di Trazione	6-Voltage Measuring sensors and data transmission network Sensori di misura di Tensione e rete di trasmissione dati

Graphs screenshot



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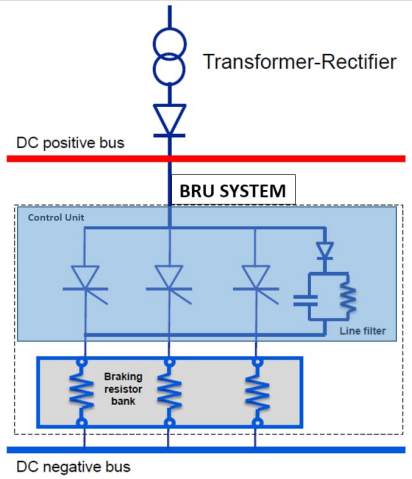
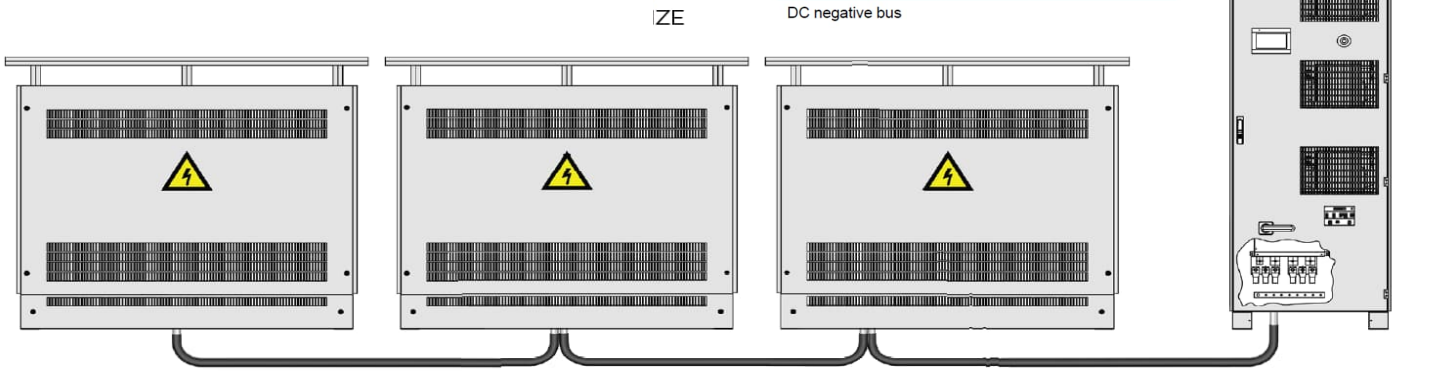
BRU - DYNAMIC BREAKING SYSTEMS

THE SYSTEM ASSURES RECEPTIVITY BY DISSIPATING THE SURPLUS BRAKING ENERGY INTO WAYSIDE RESISTORS.

IT INCLUDES:

- **1 CONTROL UNIT:**
  LOCATED IN THE SUBSTATION, WHICH SENSES THE VOLTAGE RISE AND CONNECTS LOADS TO LIMIT THE VOLTAGE RISE
- **POWER RESISTORS BANKS**
  LOCATED OUTDOOR, NORMALLY WAYSIDE OR NEARBY SUBSTATION OR DEPOT AREA.





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CONTENERISED SUBSTATIONS

Description of Project - LRT

- PHASE 1 OF JAKARTA LRT
- TOTAL DISTANCE: 5,8KM
- N° OF STATIONS: 5 ELEVATED + 1 DEPOT
  - VELODROME
  - PACUAN KUDA
  - PULOMAS
  - KALAPA GADING BOULEVARD
  - KALAPA GADING MALL
  - DEPOT
- INTEGRATION PLAN:
  - LRT JAKARTA & TRANSJAKARTA
- OPERATIONAL: END OF 2019

INDONESIA'S PROJECT – JAKARTA LRT

DC POWER SUPPLY SYSTEM

COET

SCOPE OF SUPPLY FOR EACH STATION :

- RECTIFIER TRANSFORMERS
- 12 PULSES RECTIFIER CUBICLES – 3MW
- LINE FEEDER CUBICLES
- INCOMING NEGATIVE DISCONNECTOR
- NEGATIVE PANELS WITH OVPD
- MAIN & BY-PASS DISCONNECTING PANEL

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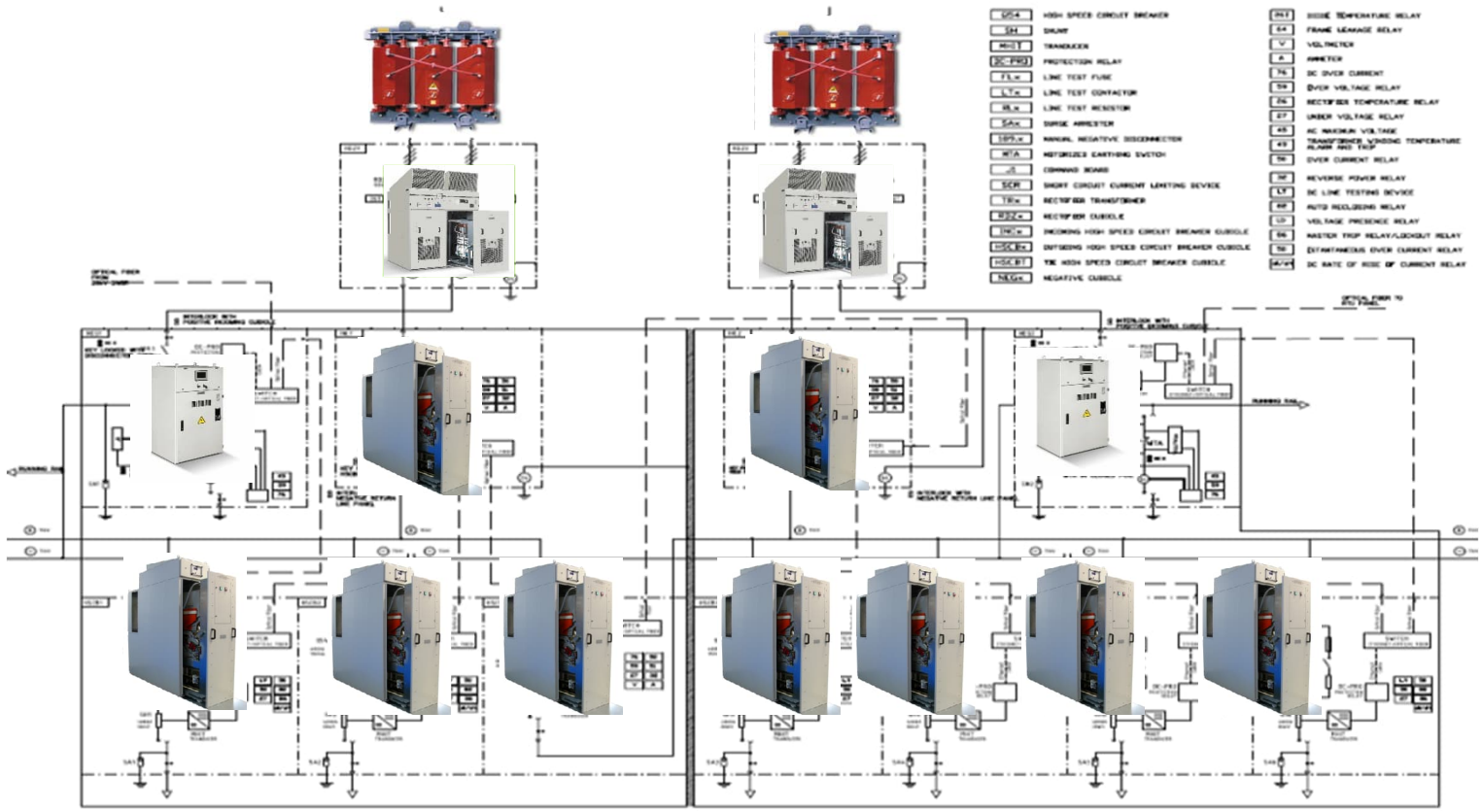

LRT JAKARTA STATIONS

SSE JAKARTA PROJECT

SUBSTATION DC EQUIPMENT FOR LRT JAKARTA

- NO. 1 RECTIFIER TRANSFORMER 3.300VA/1.650-1.650KVA
- NO. 1 RECTIFIER CUBICLE 3.000KW / 12 PULSES
- NO. 4 FEEDER CUBICLES 750V/1.500A
- NO. 1 INCOMING CUBICLE 750V/8.000A
- NO. 1 NEGATIVE DISCONNECTOR CUBICLE 750V/6.000A

LRT JAKARTA STATIONS

DEPOT STATION

SUBSTATION DC EQUIPMENT FOR LRT JAKARTA

- NO. 2 RECTIFIER TRANSFORMERS 3.300VA/1.650-1.650KVA
- NO. 2 RECTIFIER CUBICLES 3.000KW / 12 PULSES
- NO. 6 FEEDER CUBICLES 750V/1.500A
- NO. 1 INCOMING CUBICLE 750V/8.000A
- NO. 2 NEGATIVE DISCONNECTOR CUBICLES 750V/6.000A

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LATEST
DC SUBSTATIONS PROJECTS

Florence/Rome Line - Italy 3kV High Speed Line

N°16 3kV Substations each including:

- n°2 Incoming Disconnector Panels
- n°4/6 Feeders Line Panels
- n°1 Negative Panel

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RIYADH – K.S.A.
750Vdc Metro Line 3

N°18 Tractions Substations

- Load Break Switch Cubicles (4.000A)
- VLD
- Braking Resistor Systems

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KUALA LUMPUR - Malaysia

750Vdc Ampang Line

N°25 Track side IP65 Load Break Switch Cubicles (4.000A)

KUALA LUMPUR - Malaysia Monorail

N°9 Metal Enclosed Load Break Switch Cubicles (4.000A)

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ROZZANO - Italy

750V – Tramway

N°2 12 pulses Rectifiers (1MW)

N°2 Incoming Disconnector Panels

N°2 Feeders with Main Feeder & earthing disconnector

N°1 Negative Panel

BUENOS AIRES - Argentina

815V – Railway Retiro Line

N.6 SSE each including:

- N.2 6 pulses Rectifiers (2MW)
- N.1 Incoming Negative Disconnectors (4000A)
- N.1 Incoming Positive Disconnectors (4000A)
- N°4 Feeders (4000A)
- N°1 HMI Cubicle with SCADA

N.4 Outdoors disconnector cubicles

FIRENZE - Italy

750V Tramway Line 2 & 3

N.8 SSE each including:

- N°1 12 pulses Withdrawable Rectifiers (1,5 MW)
- N°2 Feeders (3000A) with Earthing disconnector
- N°1 Negative Panels with OVPD

ANTALYA – Turkey
750Vdc - LRT

N.11 SSE each including:

- N°2 12 pulses Rectifiers (3MW)
- N°1 Incoming Feeder (6000A)
- N°5 Feeders (3000A) with by-pass disconnector
- N°1 By-pass Feeders (3000A)
- N°1 Negative Panels with OVPD

IZMIR - Turkey

750V - LRT

N.4 SSE each including:

- N°2 12 pulses Rectifiers (3MW)
- N°1 Incoming Feeder (6000A)
- N°5 Feeders (3000A) with by-pass disc.
- N°1 By-pass Feeders (3000A)
- N°1 Negative Panels with OVPD

KONYA – Turkey

750V - LRT

N.6 SSE each including:

- N°2 12 pulses Rectifiers (2MW)
- N°1 Incoming Two pole Disconnector (4000A)
- N°4 Feeders (3000A)

MAURITIUS

750V - LRT

Wayside disconnector units

- Outdoor disconnectors
- Outdoors Load break switches
- Outdoors Disconnecting units

NAPOLI - Italy
750V TROLLEY-BUS

N.2 SSE each including:

- N°2 12 pulses Rectifiers (1,6MW)
- N°4 Feeders with Earthing disconnectors
- N°2 Negative Panels

VALPARAISO CHILE

3kV METRO Line

N.3 SSE each including:

- N°2 12 pulses Rectifiers (4MW)
- N°1 Incoming Feeder (4000A)
- N°4 Feeders (3000A) with by-pass disconnector
- N°1 Filter Cubicle
- N°1 Negative Panels


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