


# Traction Power System Solutions









Since 2008, AKTIF has become one of the important players in Railway Traction Power System solutions and has been providing reliable and hassle-free projects for years.

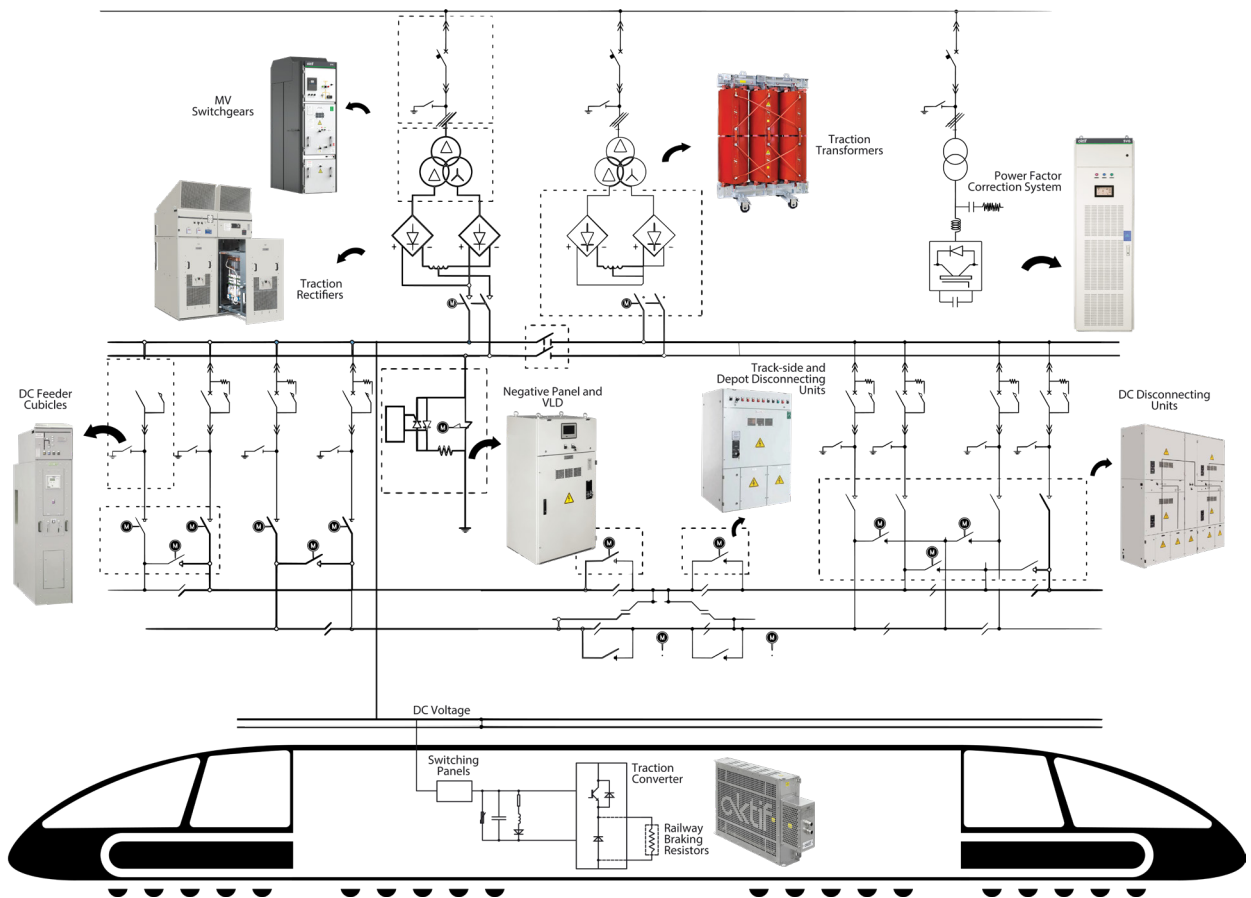
We are providing a complete system solution in Traction Power by supplying our own production MV Switchgears together with Dry Type Traction Transformers, Traction Rectifiers and DC Switchgears that we supply from European companies.

Aktif, which has expanded its production line in the field of on-board braking resistors, is on its way to becoming an international manufacturer.

Therefore, we are a strong solution partner that assures all feeding and switching equipment, as well as on-vehicle equipment, from medium voltage level to DC power needed by the vehicle in rail systems.



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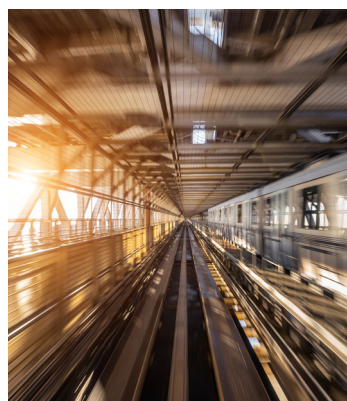
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# MV Switchgears

## Metal Clad Switchgears



SNC series Metal Clad Switchgears are switching and control cabinets manufactured between 1 kV to 36 kV in conformity with IEC 62271-200 standards, they are standing type and made by steel sheet. SNC series metal clad switchgears are two types;

- SNC-1 withdrawable circuit breaker
- SNC-2 withdrawable type circuit breaker and voltage transformer

### Main Features

- LSC-2B service continuity
- PM partitioning
- AFLR class internal arc resistant
- Accessibility all compartments from front
- 3 mm thick sheet metal as fully closed design
- Proven reliability with unique design
- Low maintenance cost
- Seismic tested reliable design in compliance with IEC 62271-210, EN60068, IEEE 693, GR-63 Core Zone 4.

Technical Specifications		
Description		SNC
Switchgear insulation		Air
Rated voltage	kV	12 / 24 / 36
Rated power frequency withstand voltage	kV	13.8/50/70
Rated lightning impulse withstand voltage	kV	75/125/170
Rated main busbar current	A	630 ... 3150
Rated feeder current	A	630 ... 3150
Rated short time withstand current	kA	16/25/31.5/40/50
Short time withstand duration	s	3
Internal arc withstand current	kV	50
Internal arc withstand duration	s	1
Rated frequency	Hz	50/60
Protection class ( when doors are closed)		IP4X
Protection class ( between compartments)		IP3X
Standards complied		IEC 62271 - 200

# Traction Transformers

## Dry Type Traction Transformers



Dry-type transformers are used in different applications such as rail system, power distribution, solar power plants, wind power plants and converter solutions in industrial facilities.

According to the requests, 6-pulse, 12-pulse, 18-pulse and 24-pulse Traction transformers are produced in accordance with IEC 60076-11 international standards for rail system and industrial applications.

### Main Features

- Storage and transport up to -50°C / +45 °C
- Rated power is 100 kVA to 20 MVA
- Rated highest voltage is up to 52 kV
- Magnetic core in transformers provide to reduce operational cost
- Manufacturing process of windings provides highest level of reliability
- Reduced operational cost due to maintenance free design

Technical Specifications	
Reference Standart	IEC-60076-11 / CENELEC HD 538.1
Rated Power	100 kVA - 20 MVA
Rated voltage	up to 52 kV
Pulse - Rating Plate	6-12-18-24 pulse (IEC 60076-11)
Type of Cooling	AN-AF
Maximum ambient temperature	45°C
Altitude	≤1000
Winding Material	AL-CU
Load Duty Class	class V - class VI (as per IEC 60146)
Indoor Enclosure	IP21-31-23
Outdoor Enclosure	IP23

## DC Switchgears

### Traction Rectifiers



Rectifiers are used to convert alternating current into direct current used to feed trains.

COET offers the most up-to-date product concepts to 750V, 1500V and 3000V DC Traction Transformer substations with its experience in the production of Traction Power Rectifiers for more than 25 years. COET Rectifiers are produced and type tested in accordance with IEC 60146-1-1 and EN 50328 international standards.

#### Main Features

- Separate compartment for power and low voltage
- Bridges connection: series or parallel
- Fixed or withdrawable execution with manual or motorized truck (optional)
- AC input from top or bottom
- DC output from top or bottom
- RC overvoltage protection

Technical Specifications	
Reference standards	EN 50328 EN 60146
Nominal voltage UN	750 V / 1500 V / 3000 V
Maximum permanent voltage U <sub>max1</sub>	900 V / 1800 V / 3600V
Maximum not permanent voltage U <sub>max2</sub>	1000 V / 1950 V / 3900 V
Rated insulation voltage UN <sub>m</sub>	1,8 kV / 3kV / 4,8kV
Rated impulse voltage UNI — to earth and between the poles — across an isolating distance	15kV 20kV 40kV 18kV 24kV 48kV
Industrial frequency voltage U <sub>a</sub> — to earth and between poles — across the isolating distance — auxiliary circuits	6,9 kV / 9,2 kV / 18,5 kV 8,3 kV / 11 kV / 22,2 kV 2 kV / 2 kV / 2 kV
Nominal current	6000 A / 4000 A / 2000 A
Nominal power	4.5 MW / 6 MW / 6 MW
Peak inverse voltage of diode	2600 V / 4500 V / 4500 V
Overload class	up to class VI

## DC Switchgears

### DC Feeder Cubicles



COET started the first DC feeder cubicle production more than 25 years ago with outstanding customer satisfaction. COET Feeder cubicles are designed for rail system applications with a switching capacity of 10,000 with 750/1500/3000 VDC. Cubicles produced in accordance with EN 50123-6 and IEC 61992-6 standards can also support different standards on demand.

#### Main Features

- 4 segregated compartments for: Low Voltage equipments, HSCB, Omnibus bar and cables.
- Multifunction Protective relay and PLC
- Earthing switch (optional)
- Interlocking system customisable on request
- HSCB and Test Equipments placed on withdrawable truck for easy maintenance with 3 positions

Technical Specifications	
Reference standards	EN 50123 IEC 61992
Nominal voltage UN	750 V / 1500 V / 3000 V
Maximum permanent voltage U <sub>max1</sub>	900 V / 1800 V / 3600 V
Maximum not permanent voltage U <sub>max2</sub>	1000 V / 1950 V / 3900 V
Rated insulation voltage UN <sub>m</sub>	1,8 kV / 3 kV / 4,8 kV
Rated impulse voltage UNI — to earth and between the poles — across an isolation distance	15 kV 20 kV 40 kV 18 kV 24 kV 48 kV
Power frequency withstand voltage level — to earth and between poles — across the isolating distance — auxiliary circuits	6,9 kV 9,2 kV 18,5 kV 8,3 kV 11 kV 22,2 kV 2 kV 2 kV 2 kV
Bus bar current	12 kA / 12 kA / 12 kA
Nominal current	8000 A / 8000 A / 8000 A
High speed circuit breaker	8000 A / 8000 A / 8000 A
Short circuit current	85 kA / 85 kA / 85 kA

## DC Switchgears

### Negative Panels and VLD



In a DC Traction System the return circuit (negative) shall usually have high insulation level against earth to limit stray currents phenomena. In case of dangerous overvoltages, the return circuit shall be short circuited to earth. For this purpose a voltage limiting device shall be installed on each negative path.

COET Voltage Limiting Device is fully in compliance with EN50526-2 standard, the most severe class (class 4) and with EN 50122-1/2 which defines all the applicable and operating criteria.

Different executions available for indoor, outdoor or inside panel mounting. Available for 750Vdc, 1500 Vdc and 3000 Vdc system, up to 100 kA short-circuit capability.

#### Main Features

- 7 inch Graphical Touch Screen Display
- Programmable single line diagram
- USB port for Setting and Data Download/ Upload
- Ethernet port for SCADA System interface
- Key lock for maintenance

Technical Specifications	
Reference standards	EN 50122-1/2 EN 50526-2
Nominal voltage	750 V / 1500 V / 3000 V
Rated insulation voltage	1800 V / 3000 V / 4800 V
Rated impulse withstand voltage — Between contacts and earth — Across isolating distance	15 kV / 20 kV / 40 kV 18 kV / 24 kV / 48 kV
Power-frequency withstand voltage — Between contacts and earth — Across isolation distance — Auxiliary circuits	6.9 kV / 9.2 kV / 18.5 kV 8.3 kV / 11 kV / 22.2 kV 2 kV
Breaking capacity	900 A
Highest peak current	35-50-100 kA
Short circuit current peak value	35-50-100 kA

## DC Switchgears

### Track-side and Depot Disconnecting Units



Equipped with motorized disconnectors or Load Break Switches, the track-side and depot disconnecting units allow to isolate portion of the track system or, in case of cross-over track application, to get very fast reconfiguration guaranteeing the continuity of the power supply and of the service.

They are available in different executions for: Indoor, Outdoor, Pole mounting and are suitable for tram, metro, trolley bus and railway applications.

#### Main Features

- Automatic earthing of the line.
- Voltage Presence Relays.
- Motor Control with Manual Emergency Operation.
- Two poles version for positive and negative isolation.
- Remote Control through PLC, Modem and battery with self powered recharge (on request).
- Self powered version (on request).

Technical Specifications	
Reference Standards	EN 50122-1/2 EN 50123-1/2/3/5/6/7 EN 50124-1/2 EN 50163 EN 60529
Nominal voltage UN	750 V / 1500 V / 3000 V
Maximum permanent voltage	900 V / 1950 V / 3900 V
Maximum not permanent voltage	1000 V / 1950 V / 3900 V
Rated insulation voltage	1800 V / 3000 V / 4800 V
Rated impulse voltage	15 kV - 48 kV
Power frequency withstand voltage level — to earth and between poles — across the isolating distance — auxiliary circuits	6,9 kV    9,2 kV    18,5 kV 8,3 kV    11 kV    22,2 kV 2 kV    2 kV    2 kV
Nominal current	2000 A - 8000 A
Short-time withstand current	up to 85 kA
Short-circuit current peak	up to 125 kA



## DC Switchgears

### DC Disconnecting Units (LBD)



In DC Traction Substations one disconnector or load break switch is normally installed downstream each High Speed Circuit Breaker thus allowing, in case of failure, to isolate the circuit breaker granting the safety of the system. The configuration is then completed by a by-pass or parallel disconnector switch connecting two feeders and allowing to grant the service continuity in case of failure of one circuit breaker: this disconnector is normally on-load and motorised for remote control.

#### Main Features

- Segregated compartments for each Disconnector and/ or Load Break Switch and for each incoming/outgoing cables
- Withdrawable execution of switch (optional)
- Segregated Low Voltage compartment
- Indoor or outdoor execution (up to IP66)
- Earth fault relay (F64) (optional)

Technical Specifications	
Reference Standards	EN 50122-1/2 EN 50123-1/2/3/5/6/7 EN 50124-1/2 EN 50163 EN 60529
Nominal voltage UN	750 V / 1500 V / 3000 V
Maximum permanent voltage	900 V / 1950 V / 3900 V
Maximum not permanent voltage	1000 V / 1950 V / 3900 V
Rated insulation voltage	1800 V / 3000 V / 4800 V
Rated impulse voltage — to earth and between the poles — across an isolating distance	15 kV / 20 kV / 40 kV 18 kV / 24 kV / 48 kV
Power frequency withstand voltage level — to earth and between poles — across the isolating distance — auxiliary circuits	6,9 kV    9,2 kV    18,5 kV 8,3 kV    11 kV    22,2 kV 2 kV      2 kV      2 kV
Nominal current	2000 A 4000 A 6000 A 8000 A
Short-time withstand current	up to 85 kA
Short-circuit current peak	up to 125 kA

## PFC System

### Shunt Reactor Banks



BSC series shunt reactor banks are designed by using ALS series shunt reactors and high technology digital reactive power control relays, protection and control equipment. Application areas are mostly subways, light rail systems and industrial zones having long transmission/distribution line cables.

Reactive power factor correction systems can be applied either with electronic switching or conventional electromechanical switching. BSC series shunt reactor banks are designed suitable to remote control, and management from the existing scada infrastructure, in addition to automatic or manual operation.

#### Main Features

- Different voltage levels and power values option
- Easy installation
- Integration option with Scada systems and remote control
- Easy power increase thanks to the modular structure
- Possibility and capability of backup, equipment exchange, and sharing within the system
- Maximum efficiency with low power losses and minimized energy consumptions

Technical Specifications	
Voltage	up to 1500 Vac
Frequency	50 / 60 Hz
Max. power in 1 panel	200 kVAr
Switching	Thyristor / Contactor
Short circuit resistance	up to 65 kA
Installation	Indoor/Outdoor
Ventilation	Fan or climate
Standards	EN 61439-1/2, EN 60076-6, EN 60529, EN 60255-1, EN 60947-4-1
Dimensions (D x W x H)	800 x 800 x 2100 mm



## PFC System

### Static VAR Generator



SVG series IGBT switching compensation systems consist of high technology IGBT drivers and modules. It can perform both inductive reactive and capacitive reactive compensation in both directions.

#### Main Features

- Immediate response to rapid and sudden load changes
- Easy installation, operation and easy power increase
- Thanks to its modular structure, easy material and equipment change, it allows backup
- Switching and compensation without causing transients and harmonics
- One-to-one independent intervention to the balanced or unbalanced load for 3 phases, 3 phase load balancing

Technical Specifications	
Wiring	3P3W, 3P4W
Reactive power rating	up to 600 kVAr
Voltage	3P3W: 200V - 480V (±%10) 3P4W: 200V - 415V (±%10)
Topology	Tri-Level IGBT based NPC
Frequency	50/60 Hz ± 3 Hz
Switching frequency	20 kHz
Reaction time	25 µs
Harmonic filtering	Up to the 13th, each one individually selectable
Power factor correction	0 - 100% inductive and capacitive
Mechanical dimensions (D x W x H)	600 x 800 x 2150 mm
Ambient temperature	-10 - +45 °C
IP class	IP20
Standards	EN 50178, EN 55011, EN 61000-6-2, EN 61000-6-4, EN 61000-3-2, EN 61000-3-3, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11
Certification	CE

## Railway Resistors

### Railway Braking Resistors



Railway vehicles need a brake system to operate safely and to control the speed easily and quickly. The braking system is classified as mechanical braking, which converts kinetic energy into heat, and electrical braking, which converts power energy into heat. When kinetic energy is converted back into electrical energy, it can slow down or stop an electric motor and this energy is dissipated using a power resistor.

Brake resistors have high power ratio and low ohm values. Railway vehicle motors work like generators during braking such generate regenerative energy and this energy damages the driver, other electrical equipments.

Railway resistors are used to avoid mechanical wear on railway vehicles, suppress voltage fluctuations and absorb regenerative power

#### Main Features

- Fast cooling
- Lighter in weight per kilowatt
- Low inductive characteristic
- Mechanical structure extremely resistant to vibrations,
- High flexibility for shock absorption

Technical Specifications	
Maximum operating voltage	25 kV
Resistance tolerance (@ 20°C)	+7/-5 %
Isolation	70 kV 1 minute (Umax = for 25 kV)
Overvoltage categories	OV1, OV2, OV3, OV4
Pollution class	PD1, PD2, PD3, PD3A, PD4, PD4A, PD4B
Protection class	IP 20
Resistor material	Stainless steel
Enclosure material	Stainless steel

## Railway Resistors

### Crowbar Resistors



Crowbar resistors are used to protect the outputs of power sources in railway systems against the short-time (transient) and long-time overvoltage failures.

Output voltage rises very fast (in microseconds) when semi-conductors of power source fail (short circuit) or the control circuit collapses. Protection system fully independent from the control system of power source detects the fast increase of the output voltage and switches the crowbar resistor connected to the power output with the semi-conductor switching system.

In this case, crowbar resistor create an over current limited to a value that will not damage the power supply but will activate the protection equipment such as fuses and circuit breakers and attenuate the over voltages very quickly.

#### Main Features

- Special sizing to fit the location of use, suitable for outdoor or indoor usage and perfect cooling
- Corrosion-resistant handling system and connectors
- Stainless steel product and warning labels
- Requested protection level from IP00 to IP55

Technical Specifications	
Maximum operating voltage	25 kV
Resistance tolerance (@ 20°C)	+7/-5 %
Isolation	70 kV 1 minute (U <sub>max</sub> = for 25 kV)
Overvoltage categories	OV1, OV2, OV3, OV4
Pollution class	PD1, PD2, PD3, PD3A, PD4, PD4A, PD4B
Protection class	IP 20
Resistor material	Stainless steel
Enclosure material	Stainless steel

## Railway Resistors

### Other Railway Resistors



Other Railway Resistors used in light rail vehicles such as high-speed trains, trams or railway vehicles such as locomotives and wagons are Charge-Discharge Resistors, Line Test Resistors, Filter Resistors and Damping Resistors.

#### Charge-Discharge Resistors

The Charge-Discharge Resistor is used to charge and discharge the DC capacitors inside the inverters in a controlled manner so that the semiconductors are not damaged.

#### Filter And Damping Resistors

Filter Resistors are used to improve the quality of the power grid and Damping Resistors are used to prevent any damage to electronic components by limiting any current and voltage peaks where the Filter Resistors improve the quality of the power grid.

#### Line Tests Resistors

Line Test Resistors are used to detect if there is any malfunction before energizing the catenary lines.

Technical Specifications	
Maximum operating voltage	25 kV
Resistance tolerance (@ 20°C)	+7/-5 %
Isolation	70 kV 1 minute (U <sub>max</sub> = for 25 kV)
Overvoltage categories	OV1, OV2, OV3, OV4
Pollution class	PD1, PD2, PD3, PD3A, PD4, PD4A, PD4B
Protection class	IP 20
Resistor material	Stainless steel
Enclosure material	Stainless steel







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