

MEIDEN

Quality connecting the next

Electrical Facilities for Railways





SAFETY TAKES PRECEDENCE OVER ALL.

Meidensha's basic concept for railway systems is the stabilized supply of electrical power.

Mass rapid transit is further increasing its significance and high reliability of transportation system is increasingly called for. To meet these requirements of the times, Meidensha railway systems offer state-of-the-art technologies in wide ranges of fields from Powertronics of substation facilities to Electronics of computer systems.

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Meidensha's Electrical Facilities for Railways Actively Playing Their Roles throughout the World



Installation of rail transport systems as environmentally friendly transportation infrastructure is advancing in cities around the world. Meidensha’s electric railway equipment is playing a part in this advance.



A bullet-train electrical substation supports stable transport of the Shinkansen, a form of high-speed mass transit.



Electric-power command facilities that support safe transport and electric-power management systems for electric railways that centrally monitor and control many substations are in use in various locations.

Constructing Rational Power Feeder Systems,
by the Full Use of Railway Simulation Technologies.

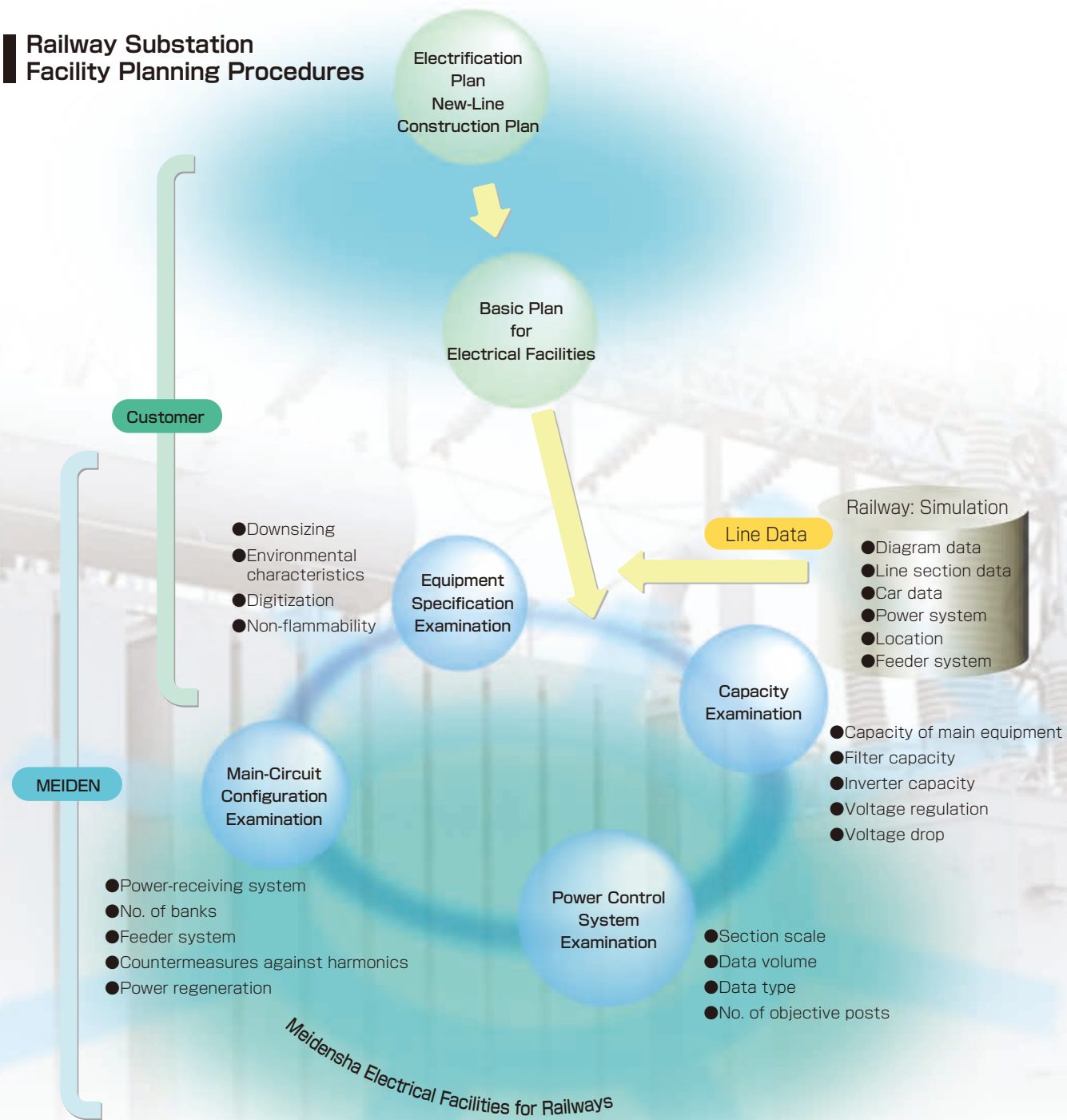
Substation Facility Plan

When planning a railway substation, the overall capacity of the facility can be defined according to the distance between substations, the transportation plan, and car performance characteristics.
In the past, this capacity was calculated based on the power consumption rate of a similar line and possible train operation diagrams.
Along with the sophistication of a traffic system, however, it has been difficult to use such a method based on experience in the past.
Meidensha Corporation will support the user to construct a reasonable feeding system through the adoption of railway simulation technologies, the introduction of power-regeneration cars to cope with densely arranged traffic diagrams, the use of thyristor rectifiers, and the installation of power regeneration inverters, with the aid of computer analysis for sophisticated feeding systems.

The Following Result Is Obtainable from Digital Simulation:

- 1)Train running curves (each section between stations)
- 2)Substation's output current, Voltage, and wattage curves
- 3)Current curves for substation feeder CBs
- 4)Max. and Min. feeder voltage curves
- 5)Frequency distribution curves

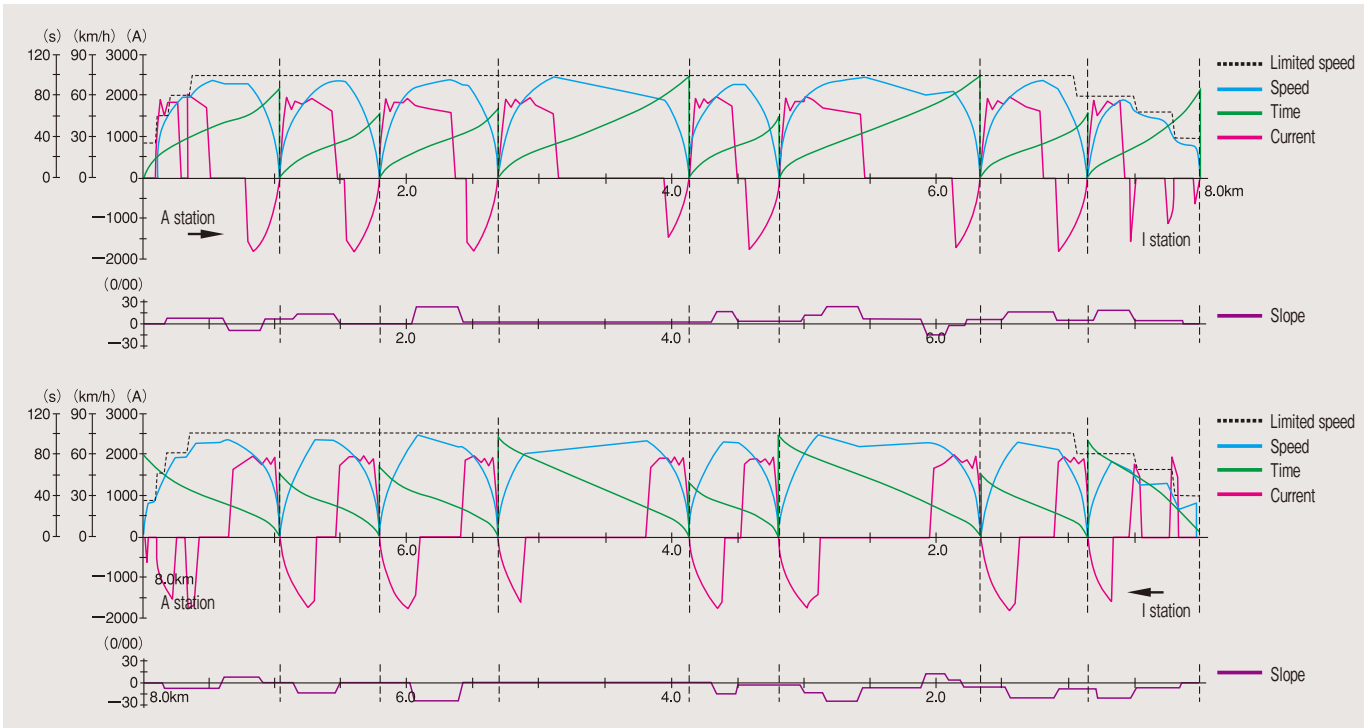
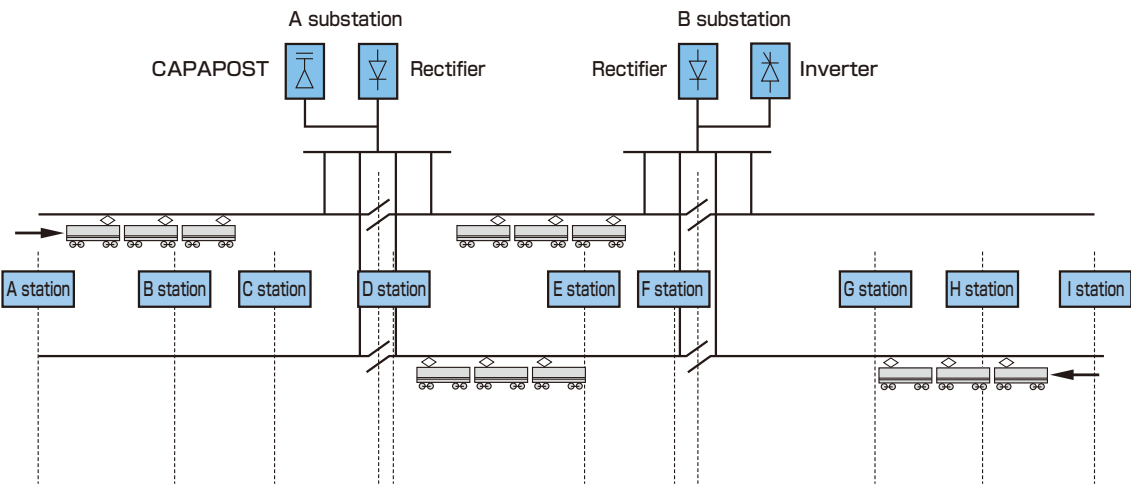
Railway Substation Facility Planning Procedures



1. Train Running Curves (for Each Section between Stations)

Grade curve	Running time curve	Average speed	Max. power-running current
Limited speed curve	Running current curve	Power-running wattage	Max. regeneration current
Speed curve	Running time	Regeneration power	Car primary unit

DC Railway Simulation Feeder System (Example)



Start station	Arrival station	Time(sec)	Power-running wattage(kWh)	Regeneration power(kWh)
A	B	98.3	344.5	-284.3
B	C	68.4	787.8	-638.1
C	D	105.0	701.2	-430.0
D	E	80.0	978.4	-686.9
E	F	102.4	584.8	-313.4
F	G	71.8	749.6	-825.6
G	H	64.5	1005.9	-657.2
H	I	88.2	833.5	-448.8

Start station	Arrival station	Time(sec)	Power-running wattage(kWh)	Regeneration power(kWh)
I	H	89.5	817.1	-448.2
H	G	85.8	1200.9	-620.9
G	F	72.1	1276.4	-536.7
F	E	102.7	735.5	-269.7
E	D	81.1	1134.4	-628.8
D	C	107.5	969.4	-325.8
C	B	87.8	1233.9	-558.4
B	A	91.5	612.4	-206.3

2. Substation Output-Current, Voltage, Wattage Curves

Substation output (power-running, regeneration) current curve
Substation output (power-running, regeneration) voltage curve
Substation output (power-running, regeneration) wattage curve
Substation current.....Average power-running current
Max. power-running current
Average regeneration current
Max. regeneration current

Substation voltageMax. voltage
Min. voltage
Substation wattageAverage power-running
Max. power-running wattage
Average regeneration wattage
Max. regeneration wattage
Substation regeneration efficiency

3. Substation Feeder CB (Circuit-Breaker) Current Curves

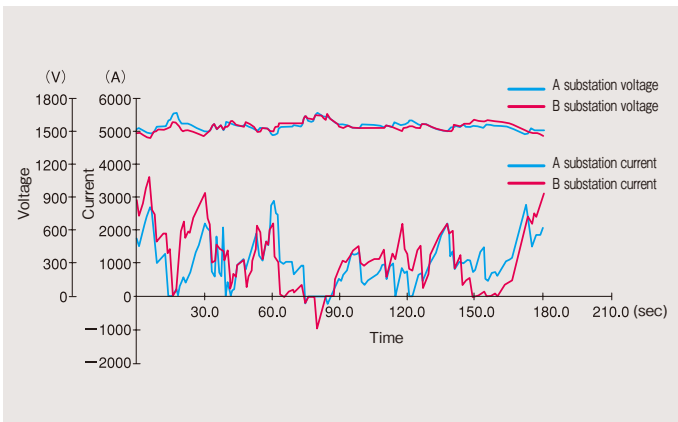
Substation feeder CB current curve
Substation feeder CB average current
Substation feeder CB average rms current
Substation feeder CB Max. current

4. Feeder Voltage Max./Min. Curves

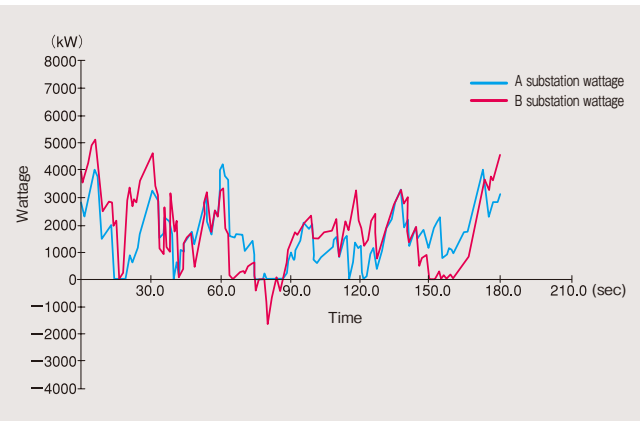
5. Railway-Car Voltage/Current Characteristics

Pantograph point lowest/highest voltage

Substation Voltage • Current Curve



Substation Wattage Curve



Result of Substation Characteristic Calculation

Name of line TEST Train configuration 4M, 2T Operation intervals(min) 3.0

	A substation	B substation
Substation location (m)	2500.00	5000.00
Rated rectifier capacity (kW)	3000.00	3000.00
Rated rectifier voltage (V)	1500.00	1500.00
Rectifier voltage regulation (%)	6.00	6.00
Rated inverter capacity (kW)	0.00	1000.00
Rated inverter voltage (V)	0.00	1650.00
Max. power-running current (A)	2923.32	3627.47
Average power-running current (A)	1265.22	1480.23
Max. power-running voltage (V)	1668.43	1648.50

	A substation	B substation
Max. power-running wattage (kW)	4263.51	5175.54
Min. power-running voltage (V)	1458.45	1426.76
Power-running (kWh)	1594.62	1776.55
Max. regeneration current (A)	0.00	998.27
Average regeneration current (A)	0.00	111.67
Max. regeneration wattage (kW)	0.00	1645.65
Regeneration (kWh)	-0.00	-29.70
Regeneration efficiency (%)	0.00	1.67

Switchgears for Power Supply System

24kV/36kV SF₆ Gas Insulated Switchgear

HICLAD 20GB/HICLAD 30GB

Features

- No exposure of high-voltage live part to the air. Complete interlocking system against erroneous operation. Equipment of manual operation mechanism in an emergency.
- Visualized operation mechanisms equipped with mimic bus and symbols. All switching devices can be operated from remote. Compact size achieved by optimal arrangement of devices.
- High-voltage live part is completely protected against moisture and dust.
- Reliable gas-insulated busbar system. Keeping the ability of braking circuit, even if the insulating gas pressure becomes zero. Enhancement of reliability by reduction in number of parts achieved by simple structure.
- Adaptable for various requirements of network by employing plug-in type voltage transformer and lightning arrester. Insulating performance is imperious to the installation altitude. Test of high-voltage part can be fully performed without any gas handling.
- Easy maintenance. No maintenance is needed for high-voltage equipment in the gas compartment. SF₆ gas is not polluted by arc because of employing VCB. (SF₆ gas is used only as insulation medium.)



Technical Data

Table 1 Switchgear							
Switchgear model		HICLAD 20GB		HICLAD 30GB			
Switchgear type		NBG-24		BGB-36			
Applicable standards		IEC62271-200					
Clasification of switchgear		SF ₆ -insulated metal-enclosed					
Service condition		●Altitude < 1000m Indoor		●Ambient temperature Max. 40℃, Min. -5℃ 24h. average < 35℃		●Relative humidity 24h.average < 95% 1 month average < 90%	
Rated voltage (kV)		24		36			
Rated current (A)		1250, 2000		1250, 2000, 2500			
Rated frequency (Hz)		50/60					
Insulation level	1 min power frequency (kV rms)	50		70			
	1.2 × 50 μs impulse (kV peak)	125		170			
Rated short-time withstand current (kA-s)		25-3		31.5-3			
Degree of protection	HV compartment	IP65					
	LV compartment	IP40					
Gas pressure	Rated pressure (MPa)	0.05		0.08			
	Alarm pressure (MPa)	0.02		0.06			
Operation of 3-position isolator		Motorized / Manual					
Auxiliary voltage	Control circuit (V)	DC 30, 110, 125, 220					
	Motor circuit (V)	AC 220, 230, 240 / DC 110, 125					

Table 2 Vacuum Circuit-Breaker (VCB)			
VCB model		NVG-22	VGB-33
Applicable standards		IEC62271-100	
Rated voltage (kV)		24	36
Rated current (A)		1250, 2000	1250, 2000, 2500
Rated frequency (Hz)		50/60	
Insulation level	1 min power frequency (kV rms)	50	70
	1.2 × 50 μs impulse (kV peak)	125	170
Rated short-circuit braking current (kA)		25	31.5
Rated short-circuit making current (kA peak)		63	82
Rated short-time withstand current (kA-s)		25-3	31.5-3
Operating duty*		O-0.3sec.-CO-3min-CO	
Rated closing time (s)		0.05	
Rated opening time (s)		0.05	
Rated break time (s)		0.07	
Rated TRV for terminal fault	Rate of rise (kV/μs)	0.47	0.57
	TRV peak voltage (kV)	41	62
Type of operating mechanism		Motor charged spring	

* : Other duties, O-0.3sec.-CO-15sec.-CO, O-0.3sec.-CO-1min-CO-1min-CO are also available.

Switchgears for Power Supply System

12kV Air Insulated Switchgear

HICLAD 10ZA

Features

- Complete interlocking system against erroneous operation. Internal Arc Classification IAC AFLR.
- Compact and Light weight. 33% less footprint than our previous type AIS on typical layout. Easy maintenance.
- MEIDEN Vacuum technology adopted. Vacuum Interrupter is made in Japan, MEIDEN Numazu factory.

Accordance with IEC62271

- IEC62271-1 common
- IEC62271-200 switchgear
- IEC62271-100 circuit breaker
- IEC62271-102 earthing switch

Type tested at KERI

- Dielectric test
- Temperature test
- Short-time and peak withstand current test
- Short-circuit current making and braking tests
- Capacitive current switching test
- Internal arcing test



Technical Data

Model		HICLAD-10ZA
Type		BZ-C-12-25
Applicable Standard		IEC62271-200
Rated Voltage		12kV
Rated Current	Main Busbar	630A, 1250A
	Branch Circuit	630A, 1250A
Rated Frequency		50Hz/60Hz
Short-Time Current		25kA-3s
Withstand Voltage		28kV
Impulse Withstand Voltage		75kV
Bus Configuration		Single Bus
Service Condition	Attitude	< 1000m
	Ambient Temperature	-5 ~ 40°C (24h average < 35°C)
	Humidity	24h average < 95% (1 month average <90%)
	Location	Indoor
Degree of Protection	Enclosure	IP4X
	Partition	IP2X
Partition Class		PM
Loss of Service Continuty Category		LSC2B (Figure 106, IEC62271-200)
Control Source		110Vdc (30Vdc, 125Vdc option)
Motor Charging Source		110Vdc (220/230/240Vac, 125Vdc option)

Dead Tank Vacuum Circuit Breaker

168/204kV

- Commercialization of the world's first 204 kV rated model.
- Guaranteed high reliability
We adopted proven double-break technology with a 168 kV insulator-type VCB.
We developed a 168/204 kV tank-type VCB. It utilizes the latest vertical magnetic-field electrode vacuum interrupter.
- Maintenance labor-saving circuit breaker
Use of a vacuum interrupter eliminates the need for inspections of the interrupter section. Life cycle cost can be reduced (total cost reduction compared to gas circuit-breakers (GCB)).
- Lower center of gravity improves earth-quake performance
Guarantees a sufficient safety factor for 0.3 G, 3-wave resonance.



72/84kV

- Contributes to the prevention of global warming due to the absence of SF6 gas by means of dry air and composite insulation.
- Because a completely self-arc-extinguishing vacuum interrupter is used, the circuit breaker can handle multiple lightning strokes and evolving-fault breaks.
- Because a vacuum interrupter is used in the shut-off section, the device is designed to save maintenance and inspection labor compared to gas circuit-breakers (GCB).
- The use of an aluminum tank provides the following benefits.
 - (1) Lightweight (27% less compared to existing types)
Effective for transportation weight, installation area, and earthquake performance
 - (2) No coating
Effective for reducing maintenance costs
 - (3) Reduction of loss of passage of electric current (85% less compared to existing types at 1,200 A)
Common up to 2000 A rated electric current



Changeover Switch (Shinkansen)

- Many of these switches are used in Shinkansen switching sections due to their multi-frequency opening and closing ability.
- The silicon steel plate lamination layer structure of the included electromagnetic iron core reduces eddy current loss.
- Optimization of the magnetic path of the included electromagnet reduces leakage of magnetic flux.
- High withstand-voltage specifications are also supported as a matching measure for power supplies of different frequencies and asynchronous power supplies.



Transformers

AC Power Transformers

This optimal design meets needs from high voltage receiving and feeding transformers for the Shinkansen to converter transformers.

Features

- We provide highly reliable equipment through design know-how cultivated over many years with the Shinkansen.
- The design can also meet low-noise and low-loss needs.
- Roof-delta winding with small size, light weight, and low loss are manufactured for high voltage feeding.



Roof-delta connection transformer

Item	Ratings
Application	For power feeding a Shinkansen train
Cooling method	Oil immersed self-cooling type
Rated capacity	Up to 120 MVA
Duty class	300% for 2 min.
Rated primary voltage	Up to 275 kV
Connection	Roof-delta connection



154 kV Scott connection transformer

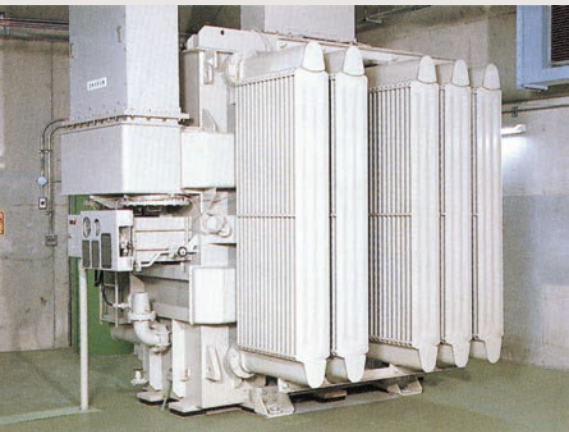
Item	Ratings
Application	For power feeding a Shinkansen train
Cooling method	Oil immersed self-cooling type
Rated capacity	Up to 100 MVA
Duty class	300% for 2 min.
Rated primary voltage	Up to 154 kV
Connection	Scott connection

Rectifier Transformer

Features

- We achieved the optimum design to meet special rated values, including electric railway load Class VI and Class S, with the goals of small size and light weight.
- Various types can be supported, including radiator package types, by-radiator installation types, auxiliary-transformer mounted types, and primary and secondary bushing, and bus duct systems.
- Meticulous quality control provides high reliability.

Transformer for Rectifier



Gas-insulated transformer



Oil-immersed transformer



Cast resin transformer

12-phase rectifier transformer

Item	Ratings
Application	For DC Traction power supply
Insulation	Gas / Oil / Cast Resin
Rated capacity	Various range available
Duty class	Class VI (100% continuous, 150% for 2 hr., 300% for 1 min.)
Rated primary voltage	11kV/22kV/33kV
Connection	12-phase transformer Y-△

*The above specifications are typical example.
Another special specification is also available depending on the requirements.

Transformers

Power Distribution Transformers

Gas-Insulated Transformer

Features

- Since SF₆ is used and core and windings are contained in a hermetically-sealed vessel, this type of transformer can be used safely in a building or underground town.



Gas-Insulated Transformer

Cast Resin Transformer

Features

- The insulation layer that forms the coil is a flame resistant epoxy-resin processed FRP insulator. Because insulating oil is not used, the number of firefighting facilities that must be installed by law can be reduced.
- Use of a wound core of high-grade electro-magnetic steel plate and the compact size greatly reduced non-load loss.



Cast Resin Transformer

Oil-Immersed Transformer

Features

- Various patterns are available for bushing allocations, bus-duct shapes, etc.
- In addition to self-cooled type, there are, many types available, such as oil-immersed forced-air-cooled type, oil-immersed water-cooled type, forced-oil self-cooled type, forced-oil forced-air-cooled type, etc.
- Low-noise type is also available.
- Environmentally friendly transformers that use flame-resistant low-viscosity silicone oil are also manufactured.
- Transformers that use palm oil can also be manufactured as an environmental response.



Oil-Immersed Transformer

Power Converter Equipment

Natural Cooling Rectifier

Features

- Silicone diodes integrated with heat sink
- Simple construction
- Compact construction
- Easy maintenance and inspection

Specifications

Rated voltage	750V
Duty class	Class VI (100% continuous, 150% for 2 hr., 300% for 1 min.)
	Class S
Cooling method	Natural cooling
Installation location	Indoor



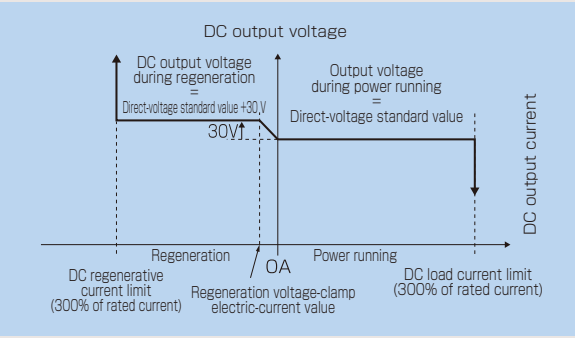
Double Converter



This unit enables the constant voltage control of feeding voltage, even in case of the sudden load fluctuations, and returns the regenerative power from electric trains to the AC side by inverting the power. This controls the cross-flow current flowing between substations and reduces feeding power loss, earth leakage current and touch voltage.

Converter rating

Item	Example installation
Rectifier	2000kW S type (100% continuous, 150% for 2 hr., 300% for 1 min.)
Inverter	500 kW S type (100% continuous, 300% for 1 min.)
Nominal voltage	DC 750V



Power Converter Equipment

Regenerated Power Absorbing Controller

Braking Resistor Unit (BRU)

Principle of Operation

The main dc input terminals of BRU are connected across the positive and negative traction system and its output is connected to the regenerative resistor unit.

The control circuit will be triggered when the braking train(s) regenerates the excess energy and boost the traction line voltage up to the preset value. BRU regulates the traction voltage to setting voltage by means of dissipate the energy at the resistor unit. Its concept is shown as Fig. 1.

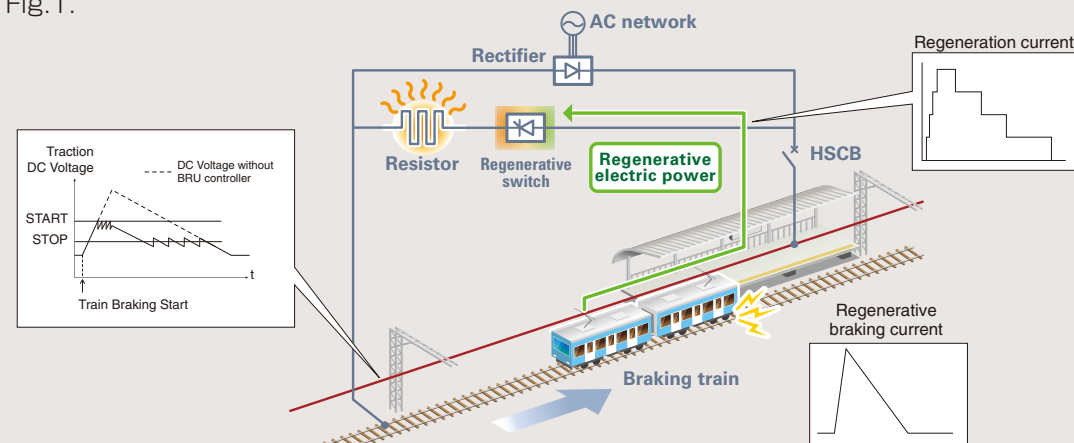


Fig.1 Concept of BRU Control

Rating and Specification

The standard rating and specification of BRU are shown in Table 1.

Table 1. Rating and Specification of BRU

Description	Rating and specification				Notes
Applicable standard	IEC60146				
Capacity	Ipeak	3000A	4000A	5000A	Based on current characteristics shown in Fig.2
	Irms	822A	1118A	1354A	
Control method	Stepwise firing control				
Rated class	Class S				Based on current characteristics shown in Fig.2
System voltage	750V				
Setting voltage	770V to 850V				Variable in 1V step
Maximum voltage	900V				

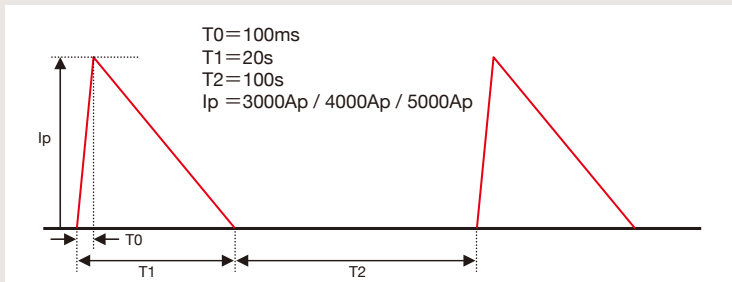


Fig.2 Typical regenerative braking current characteristics

KAISEI PLUS

The technical principle of KAISEI PLUS is same as Braking Resistor Unit (BRU), and the PWM chopper control method is applied for KAISEI PLUS. The standard rating and specification of KAISEI PLUS are shown in Table 1.

Table 1. Rating and Specification of KAISEI PLUS

Description	Rating and specification			Notes
Applicable standard	IEC60146			
Capacity	Ipeak	2600A	3600A	Based on current characteristics shown in Fig.2
	Irms	671A	930A	
Control method	PWM chopper control			
Rated class	Class S			Based on current characteristics shown in Fig.2
System voltage	750V			
Setting voltage	770V to 850V			Variable in 1V step
Maximum voltage	900V			

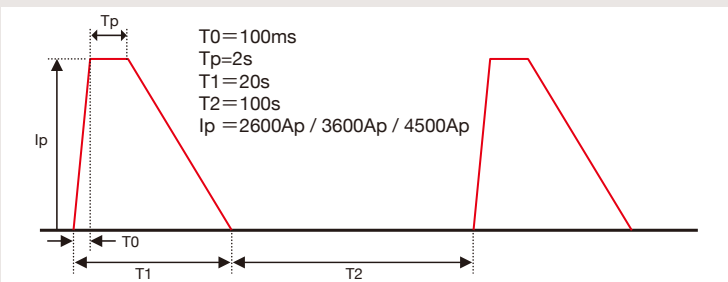


Fig.2 Typical regenerative braking current characteristics

Regenerative Inverter

Supplying regenerative energy from electric-train braking to station-building power-sources and so on maintains the validity of regeneration, and the effective use of energy contributes to energy conservation and reduces environmental burden.

Features

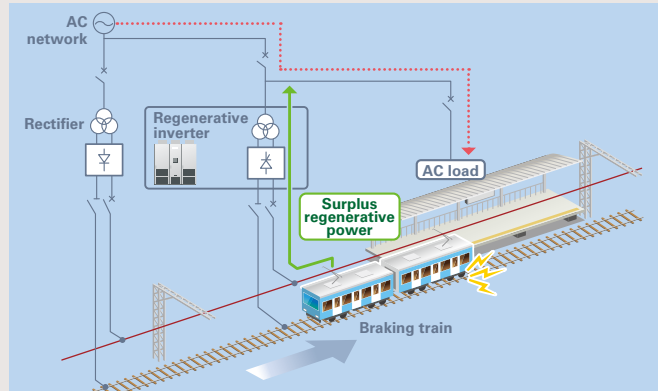
- High efficiency
- User-Friendly interface
- Quick DC voltage control



Ratings / specifications

Control method	Thyristor control	
Cooling method	Natural air cooling	
Type of rating	S type (100% continuous, 300% for 1 min.)	
Direct-current rating	Rated voltage	830V
	Rated current	1205A
	Rated capacity	1000kW
	Maximum allowable voltage	900V
Alternating-current rating	Number of phases	2 x 3-phase
	Rated frequency	50Hz , 60Hz
Performance	Regeneration start voltage setting range	770 to 850 V

Configuration



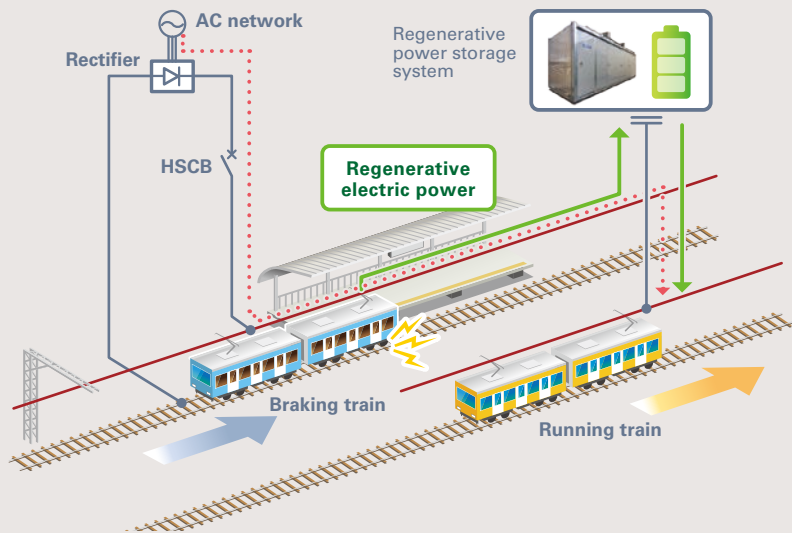
Power Converter Equipment

Regenerative Power Storage System

CAPAPOST



Direct-current electric-motor vehicles have a braking system that converts the kinetic energy from braking into electrical energy (regenerative electric power), and then supplies that energy to other electric loads. We built the optimal feeding system for energy saving by storing braking energy in an electric double layer capacitor and supplementing the energy to run electric vehicles in accordance with the feeding circumstances.



Achieves energy conservation through the effective use of regenerative power

- Absorbing regenerative power and releasing it while power is running is an economical use of energy and contributes to the reduction of emissions of carbon dioxide, a greenhouse gas.
- The effective use of regenerative electrical energy demonstrates its power in the peak shaving of electric-railway loads, which have large fluctuations.
- Energy is absorbed during braking, which maintains the validity of regeneration.
- Regenerative vehicles can be introduced to train lines, which has been difficult to do up to now.

Electric double layer capacitor is used

- Because the electric double layer capacitor does not use chemical reactions in charging and discharging, it has excellent characteristics for repeated charging and discharging and rapid charging and discharging.
- The electric double layer capacitor is an environmentally friendly product as it does not use any heavy metals.
- Because the electric double layer capacitor is connected to the feeding wire via a step-down and step-up type chopper, high-voltage receiving equipment is not required.

DC Switchgear

High Speed Circuit Breaker Panel

HICLAD D

Features

- Applicable standard: IEC 61992
- Large capacity: Rated current 8000A Max.
- High braking capability: Rated short-circuit current 125kA
- Compactness and lightness
- Simple and highly reliable construction
 - Permanent magnet holding system
 - Magnet operation system
 - With simplified mechanisms and the extremely reduced number of parts, maintenance is simplified and high reliability is assured.

Ratings

Description	Ratings	
Rated voltage	900V DC	1800V DC
Rated current	4000 / 6000 / 8000 A	4000 / 6000 A
Nominal voltage	750 VDC	1500 VDC
Power-frequency withstand level	9 kV	9 kV
Rated short-time withstand current	71kAp / 50 kA at 250ms	71kAp / 50 kA at 250ms
Rated track time-constant	100 msec	100 msec
Rated short-circuit current	180kAp / 125kA	142kAp / 100kA
Bi-directional critical current *1	25 A	26 A
Mechanical endurance	50,000 operations	50,000 operations
Degree of protection	IP3X	IP3X
Breaking characteristics	H	H
Rated insulation voltage	1.8 kV	3 kV
Auxiliary operating supply *2	50 / 110 VDC	50 / 110 VDC

*1:As defined in BS EN 50123-1:2003,the critical current quoted is the current with the longest arcing time.At900V/25A the arcing time is approximately 330ms.

*2:Other optional voltage for auxiliary operating supply is available.



Miscellaneous DC Panels

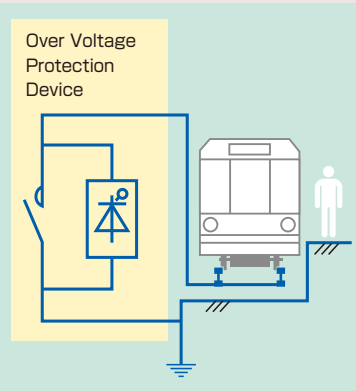
Over Voltage Protection Device

Over Voltage Protection Device (OVPD) limits hazardous voltages between traction return circuit and earth within the permissible value allowed in EN50122-1.

If the touch voltage exceeds pre-defined limit, the return circuit is solidly connected to earth.

Rating

Rated Voltage	900V DC
Rated short time withstand current	50kA/100kA



Disconnect Switch Panel

Depend on needs, various main circuit configuration can be designed.

- Negative Return Circuit
- Section Bypass
- Depot Distribution

Ratings

Description	Ratings	
Rated voltage	900V DC	1800V DC
Rated current	4000/6000/8000 A	4000/6000 A
Nominal voltage	750V DC	1500V DC

Highly Reliable Product Created from an Abundance of Experience

Lightning Arrester

SORESTER (Lightning Arrester)

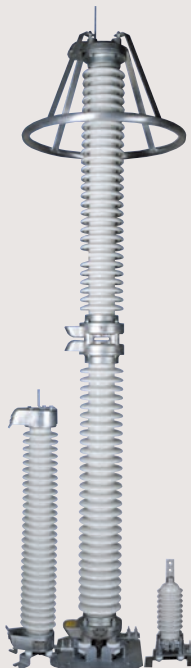
Meidensha utilized over 20 years of experience with zinc oxide lightning arresters to improve protection performance and guarantee small size, light weight, and high reliability for its arresters.

Porcelain Insulation Type

- The high-strength porcelain tube improves earthquake performance.

Polymer Type

- This direct-mold type unifies the element unit and polymer housing.
- Use of highly weather-resistant silicone rubber substantially reduces size and weight.



Support the Stable Supply of Traction Power

Power Control Systems

Power SCADA Supervisory Control and Data Acquisition

The traction power distribution control and monitoring system(Power SCADA) for Railway. Support the safety and stability of railway transportation by this product.

Features

- From high-speed rail to conventional lines, there are number of supply rerord of Power SCADA.
- A scalable, reliable software based on own real-time technology.
- Applying of human-centered design in pursuit of ease of use.
- RTUs that has been manufactured in our own factory are comply with IEC60870.



SCADA Function List

Function category	Individual functions	Function category	Individual functions
Monitoring functions	Status monitoring	HMI functions	Security management
	Numerical monitoring		Monitoring confirmation
	RTU monitoring		Mute
	System monitoring		Tag
	Latest alarm display		Automatic display
	Advance maintenance		Screen printing
	Monitoring configuration	Record statistics functions	Operation control recording
	Individual control		Alarm summary
Control functions	Dummy equipment control		System error recording
	Command sequence control		SOE information
	Time schedule control		Communication statistics
	Power-outage planning connection	Energy management functions	Demand monitoring
	Cellular telephone connection		Demand control
	Control configuration		Trend graph
Engineering functions	Data maintenance	System configuration control functions	Report creation
	Internal simulation functions		Configuration control
	User information maintenance		System monitoring

OCS Inspection System

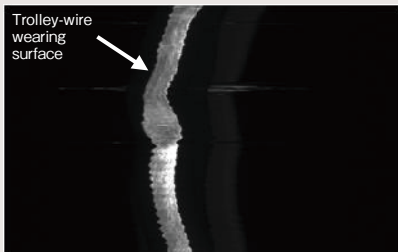
CATENARY EYE

OCS(Overhead Catenary System) Inspection System (CATENARY EYE)

This system uses edge detection processing, model matching, and other image processing technologies to inspect overhead railway wiring items that must be maintained and inspected.

Features

- The system can be applied to various overhead wiring types (single/double overhead wiring and single/double overhead rigid wiring).
- The camera provides a compact system configuration, and the system can also be loaded on commercial vehicles.
- Images allow easy confirmation of locations that require special attention.
- This system can measure wavelike wear, which is not possible with existing devices.
- Daytime and nighttime inspections are possible.
- Inspection items
 - Height, stagger, gradient
 - Pull-off arms detection, overhead crossing / contacting detection, obstacle detection
 - Pantograph monitor
 - Wear (remaining diameter), contact force (hard spots), contact loss
 - Car movement, Structure gauge clearance
- Analysis on board train
Height, stagger, wear, and other important items can be analyzed on board a train.



Example of overhead wire wear



Wavelike wear

OCS Pole Monitoring

A camera attached to the head car records video of the route while the vehicle is running. After traveling the route, an office personal computer automatically extracts only OCS poles from the route video, which are saved as equipment ledger images, and the video of the route is played back for an inspection of the route.

Features

- High resolution video from an HD camera
Because the high image quality makes OCS poles clear, it is optimal for equipment ledger photographs.
- The view from the head car provides excellent video
The video has a clear view, so abnormalities of OCS equipment and train lines can be detected visually.
- OCS pole images are organized and saved automatically
Images of the latest state of OCS poles can always be managed close at hand to add powerful support for work to update complex equipment ledgers.

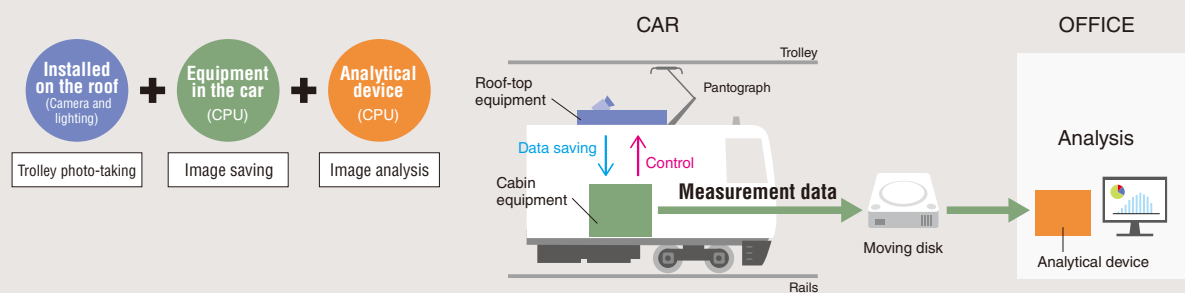
Contact Loss Measuring Equipment (Photo-Diode Model)

The contact loss measuring instrument is equipped with an ultraviolet sensor and detects contact loss that occur between pantographs and trolley wires.

Features

- The instrument is installed in ahead and behind the pantograph to detect contact loss.
- The equipment detects ultraviolet rays with wavelengths from 220 nm through 275 nm that occur during contact loss.
- A photo-diode converts the ultraviolet rays to electric voltage or electric current signals, which are then sent to a onboard computer to record the signals and display the results.

System Configuration



On-Board Equipment Installation Categories

Class 1 : High-Speed Rail / Shinkansen

Features

- All rooftop equipment is built in the rooftop cover in order not to affect the aerodynamic force of the pantograph.
- The contact force measurement using a non-contact method is the first application case in the world.
- Running Speed : Up to 350km/h.
- Daytime and Nighttime measurement.

Measurement Items

- Height, Stagger, Wear, Gradient, Pantograph monitoring, Geometric between mainline and crossover, Contact force, Contact loss
- Option : Geometric between pantograph and crossover



Class 2 : Conventional Commercial Service Car

Features

- For Non-inspections : The car is available for commercial service (The on-board equipment is removed).
- For inspections : Mounts the on-board equipment on the out-of-service car.
- Running Speed : Up to 160km/h.
- Daytime and Nighttime measurement.

Measurement Items

- Height, Stagger, Wear, Gradient, Hard spot, Pull-off arms detection, Pantograph monitoring
- Options : OCS pole monitoring, Contact loss
- Car movement, Structure gauge clearance



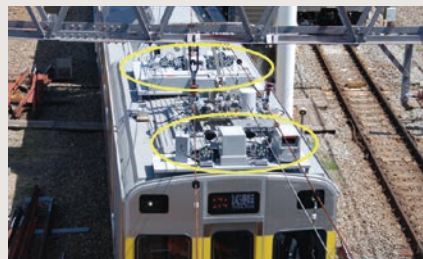
Class 3: Conventional Dedicated Inspection Car

Features

- Both rooftop and on-board equipment are permanent installation.
- Running Speed : Up to 120km/h.
- Daytime and Nighttime measurement.

Measurement Items

- Height, Stagger, Wear, Gradient, Hard spot, Pull-off arms detection, Pantograph monitoring, Geometric between pantograph and crossover, Geometric between pantograph and pull-off arms.
- Options : Contact loss, OCS pole monitoring
- Car movement, Structure gauge clearance



Class 4 : Dedicated Inspection Car / Road-Rail Vehicle

Features

- Static measurement without pantograph.
- Rooftop equipment and on-board processing PC are removable.
- Laser sensor is used for height measurement.
- Running Speed : Up to 40km/h.
- Nighttime measurement.

Measurement Items

- Height, Stagger, Wear, Gradient
- Options : OCS pole monitoring, Pull-off arms detection





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