

Jeffy and Unity guide you through all the astonishing aspects of Furukawa Electric!

How do you do?  
We are members of the Japanese Akita breed of dogs.

**Jeffy**

(Elder brother with uniform number 2)

**Unity**

(Younger brother with uniform number 9)



Jeffy and Unity are the team characters of Jef United Ichihara Chiba.

# Furukawa Here and There

Telling the truth

Furukawa Electric Group products are used in many situations in our daily lives.

**Even** though you may not actually see the products of the Furukawa Electric Group that often, they are used in many familiar places.

Furukawa Here and There is a series featuring astonishing stories about these products, told with a focus on different scenes and topics in daily living.

This issue features railways, where you for sure will find Furukawa products here and there.

## Featured in this issue: Railways

50 years after its first operation, the Japanese high-speed 'Shinkansen' trains keep excelling in the fields of speed and safety. With the debut of the 'Hayabusa' trains in 2011, which run at a maximum speed of 320 km/h, and the opening of new Tohoku, Kyushu, and Hokuriku lines in recent years, the Shinkansen is an increasingly fast and convenient way of transport in Japan and attracts worldwide interest. It is not just speed, but also safety that gives the Shinkansen its fame. With zero fatal accidents ever since its opening, and a swift restoration

after the March 2011 earthquake and tsunami, the Shinkansen is one of the most reliable means of transport. The Furukawa Electric Group actively contributes to the improvement of speed and safety of the Shinkansen, and of railways in general worldwide. We have been at the dawn of railway electrification in Japan, and continue to support the development of the railway industry by providing reliable, high quality products and solutions for energy, signals and communication systems.



Furukawa Electric supports  
Jef United Ichihara Chiba.

# Let's start looking for Furukawa Electric Group products!

Let's go!



## Railway station



When you look closely, you can already find many products on the platform!

## Platform

You are right! There's much to discover here!



## Things we can see from platforms

### Signal and telecommunication cables



#### Signal cables

Signal cables ensure punctual train operation in a safe and efficient way.



#### Telecommunication cables

These cables are for transmitting guidance and announcements, voice information for operators, data on operation statuses, weather information, and other data. They help to enhance services and efficiency.

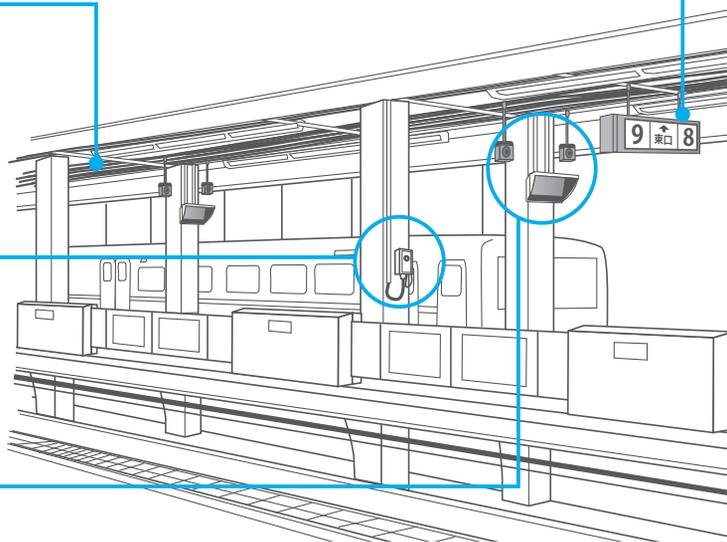


### MCPET

**MCPET**, a mysterious plastic with reflection ratios greater than those of a mirror, brightly displays the destination board, timetables, inner-lit signboards, and other information with a reduced number of light sources.

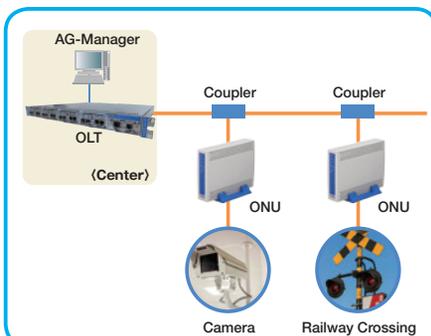


It saves energy alright!



### GE-PON

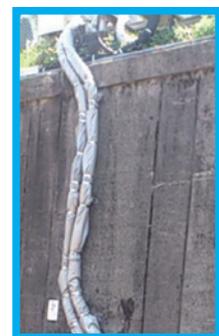
The **GE-PON system** supports safe transport systems by transmitting large amounts of information, such as camera images from platforms or railway crossings, through a single optical fiber.



### Fire-retardant sheet

#### Fire-retardant sheets

Fire-retardant sheets can be simply wrapped around cables and pipes to protect them from flames. With their fire-retardant and thermal-insulating properties, they are for both indoor and outdoor use.



# Components used on rolling stock

With Shinkansen trains



Amazing!



## Flexible conductors

Connect **high-current components**. They can withstand shocks and high temperatures and are used on rolling stock.

## Rotor bar for commutator motor

Wheels rotate when the shafts are rotated by electromagnetic force. A **copper strip bus bar (rotor bar)** is used as one of the critical components for generating the force. The component is being used in Hayabusa and other Shinkansen rolling stock in Japan, and with high-speed trains in China and other countries.



With other trains



Furukawa's products support stable train operation!



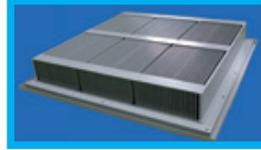
## Back-up power supply for rolling stock

Rolling stock is equipped with **alkaline storage batteries**, to supply power to rolling stock equipment when pantographs are energized or in the event of power failure.



Example application

## Power Kicker

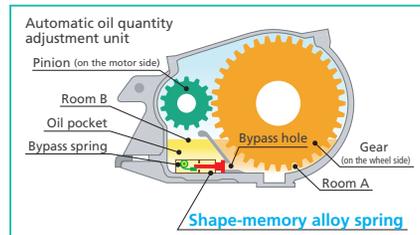


Seems a highly effective way to save energy and prevent noise too!

Many trains are equipped with a **heat sink (power kicker)** for cooling power transistors that control the electric voltage and frequency. With the N700 rolling stock of Tokaido Shinkansen lines, there are no electric fans. Instead, our **ultra high-performance power kicker [PK-S]** - which holds the **leading market share** - is being used. It is capable of cooling high-power transistors with the air flow generated during operation. The power kicker is also being used in high-speed trains in China and other countries.

## Ni-Ti shape-memory alloy spring

**Shape-memory alloy springs** in the automatic oil quantity adjustment unit inside of gear boxes sense the oil temperature. They open and close automatically, and supply the optimum quantity of oil to shaft bearings. The system helps save electricity during high-speed operation.



## Electric wires for rolling stock

All components inside a train are connected by electric wires for rolling stock. **600V lightweight polyamide electric wires for rolling stock** have enabled wire diameters and weight to be reduced, because insulation was made possible at a small thickness. The product accommodates increasing number of wires necessitated by the advanced functions of rolling stock, and reduces wiring space. It also boasts impressive strength and flame retarding capabilities, is halogen-free, safe, and secure.



Electric wires for rolling stock There are also **jumper wires** connecting rolling stock



Can I see an electrical substation over there?



## Products used at power installations

### Ultra high voltage power cables/terminals

These **ultra high** voltage power cables and terminals are used for the supply of ultra-high voltage electricity from the power plant to the substation.



### Composite insulator

Insulators are used to isolate the space between an electric wire and its supporting structure. The silicon **composite insulator** is lighter, more workable, and more eco-friendly compared to typical porcelain insulators.



### Bus duct

**Bus ducts** are assemblable distribution installations that allow for transmission of high currents without taking up much space.



### Rokumaru

**Rokumaru** is a fire-resistant blockwork kit. It is compatible with the fireproof compartment penetration section of various cables, wires and ducts, and can withstand flames for 60 minutes.



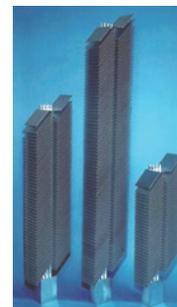
## The role of an electrical substation



To reduce transmission loss, electricity from the power plant is supplied with a high voltage alternate current. An electrical substation transforms this high voltage alternate current to a lower, direct current, so that it can be used by the railway.

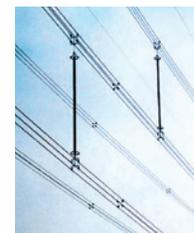
### Self-cooling vertical heat sink

The **self-cooling vertical heat sink**, which combines a heat pipe with a specially-shaped fin, enables natural air cooling in railway electrical substations.



### Interface spacer

Strong gusts of wind on electric wires may cause short circuit or breakage of wires. The **interface spacer**, placed in between electric wires, minimizes the vibrations caused by wind and protects the wires from damage.



### OPGW

Main electric wires are protected from lightning thanks to a ground wire placed on the upper part of a feeder line. The **OPGW**, a ground wire with optical fiber inside, both protects the electric wire from lightning and allows for transmission of information.

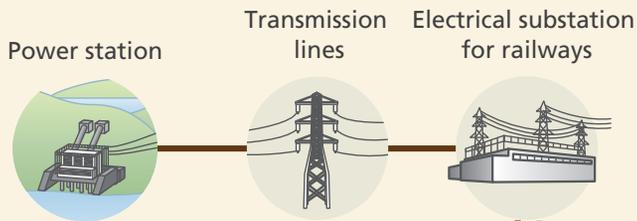


Very important!

# How do trains move, anyway?

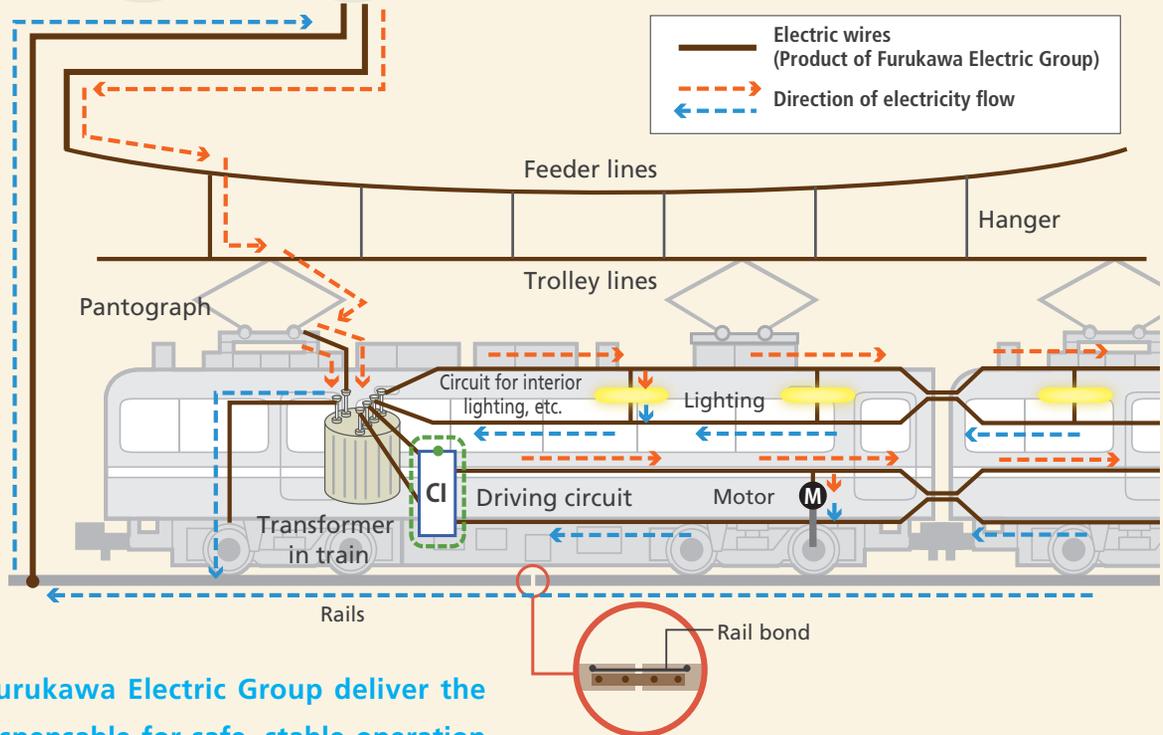


Now we see that trains move because of the flow of electricity.



The electricity supplied via a pantograph returns to the substation through the wheels and rails. The trains run only when the route is connected and the electricity flows through.

This is a schematic representation of the flow of electricity to operate trains.



Products of Furukawa Electric Group deliver the electricity indispensable for safe, stable operation of trains and services.



## Rail bond (Copper thermite welding method)



Rails stretch and contract with the temperature, so gaps open at the joints between rails. This can interrupt the circuits for electricity and signals. Rail bond is therefore used to connect two rails electrically. Rail bond of copper thermite welding method is highly workable, and offers high strength and durability.

That helps trains to run on schedule even on snowy days.



## Power cables for snow melting machines



Electric snow melting machines that melt the snow accumulated on points enable stable train operation. Power cables for snow melting machines have been used with many railroads in areas receiving snow.



Hey, look! Three antenna bars appear on my mobile phone even in a tunnel!!



Dead band system

Let's take a look inside a tunnel

A tunnel along Shinkansen line opens up just for readers!

Hanger Trolley line

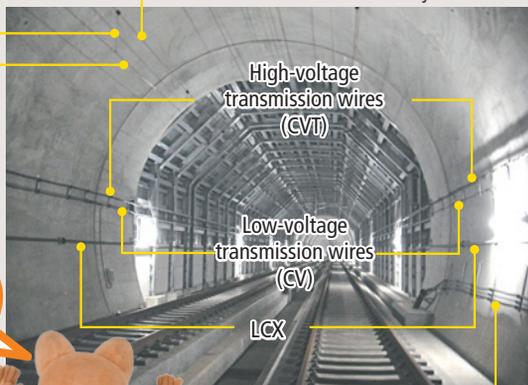
Feeder and catenary lines

High-voltage transmission wires (CVT)

Low-voltage transmission wires (CV)

LCX

Signal and telecommunication cables



This is how everything is arranged!

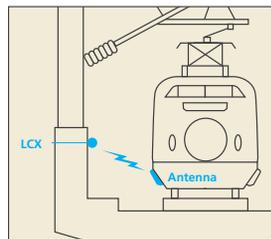
Tunnel

Wow, this is how the system works!

## Things we can see from train windows ①

### Leaky coaxial cable (LCX) for mobile telecommunication

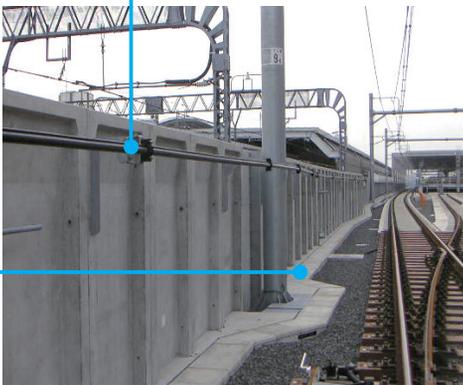
**LCX cables** enable wireless communication on board of a train, by permitting radio waves to leak out from thin holes (slits) pierced on the outer conductive body and using the cables themselves as antennas. Stable conversation is possible using a mobile phone, even in a tunnel or from a Shinkansen train running at high speed.



Communications are exchanged between train antennas and LCX

### Optical fiber cables

**Optical fiber cables** are being used with high data-rate, large-volume telecommunication networks.



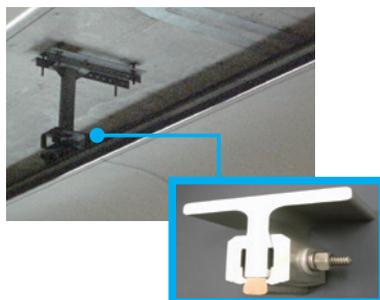
### Optical wind/rain measurement systems

These systems use an **optical sensor** for real-time **measurement of wind velocity and rainfall** and are an important part of prevention of damage from extreme weather.



### Overhead conductor rails

**Overhead conductor rails** conduct high current in a safe way and have a low deflection. They are used for power supply to trains in tunnels, where there is limited space for electrical wires.



## Things we can see from train windows ②

### E-shaped railroad switch

With the **e-shaped railroad switch**, an extra wire is installed to reduce the length of existing power distribution cables, with the aim of improving the efficiency of inspection and maintenance. The product has proven useful when opening a new shop on the station premise, installing fences with doors, and other cases when new devices that use electricity are installed.



### EFLEX

**EFLEX** is a resin protective duct for burying cables alongside railways. The product offers excellent strength, durability, weather resistance, and chemical resistance. It is long, easy to bend, conserves energy and shortens the period when installing.



### EF Liner

**EF Liner** is a resin protective piping for housing cables that run parallel with railways. It can be opened and closed at a snap, allowing installation and extension while wires are being energized. This permits energy conservation and shortens the construction period.



## Products we can see at the construction site



### Green Trough

**Green Trough** is a covered protective duct made of recycled resin, and is used for burying cables near the surface of land alongside railways. Its weight is only one-quarter of that of concrete ducts, enabling ducts to be transported manually and reducing the construction period. In addition, ducts made of recycled plastics are eco-friendly and offer excellent strength, flame retarding properties, and workability.



### LED flashing light

Visible from 800 meter even during daylight, the red light from the **LED flashing light** guarantees the safety of track maintenance workers.

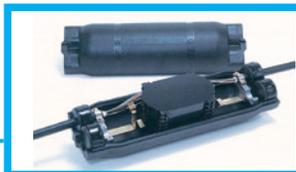


There is still a lot of maintenance work done on the tracks even after the trains have stopped running!



### Fusion splicers

Connector loss is a big issue when transmitting large amounts of optical data. The compact **fusion splicers** carefully connect fibers with minimum loss.

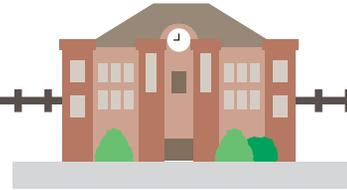


### Closures

**Closures** are connector boxes that protect the connecting end of the fibers from outside. The closures are designed to be placed economically inside a trough.

Hi, I'm back!!

## Railway station



Did you know that the products of Furukawa Electric Group are also being used with automatic ticketing machines, railroad crossing monitoring systems, and many other systems?

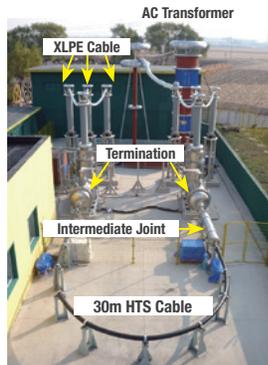


# Furukawa Electric Group's eco-friendly technology

The rapid expansion of railways worldwide comes with an increasing need for electricity. Furukawa Electric Group answers to this need by providing cables and electricity storage systems for economic transmission and storage of renewable energy.

## Superconducting power cables

These cables, made up of an oxidized high-temperature superconductor material which makes electrical resistance zero at the temperature of liquid nitrogen (-196°C), significantly reduce the transmission loss. When used as railroad feeder wires, they can contribute to CO<sub>2</sub> reduction because of the decreased need for electric substations.



Layout of 275 kV -3 kA superconductor cable demonstration

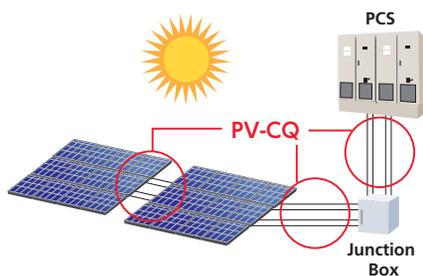
## Next-generation fly wheel

A fly wheel stores electricity as kinetic energy of a fast-spinning disk. Thanks to the use of a superconductive magnetic bearing, its rotation is totally contactless, which allows for low-loss, long-term and highly-stable operation.



## DC1500V PV-CQ Cables for large solar parks

These cables are for large solar power installations which use direct current of 1500 V. They are highly resistant to light, extreme temperatures, fire, and external damage. Being halogen-free, they are eco-friendly too.



## Package energy storage system with long-life lead-acid batteries

This energy storage system serves as an emergency energy source in the event of a blackout and facilitates peak-shaving during normal hours, and stores surplus and night time energy. It can also be linked with solar power systems and is easily installed and transported as both the storage batteries and the control equipment are housed in one container.



Package energy storage system with long-life lead-acid batteries

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