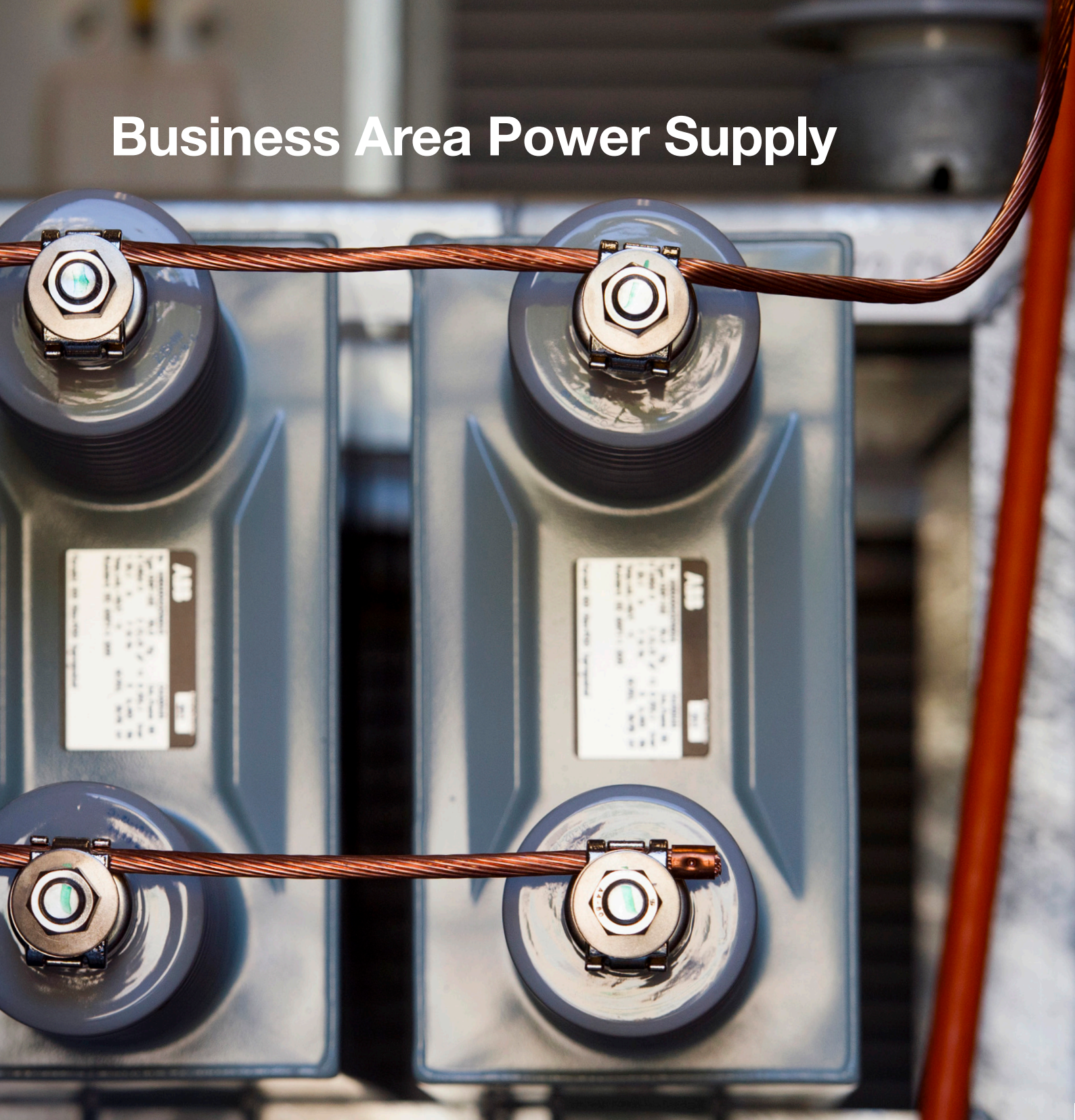
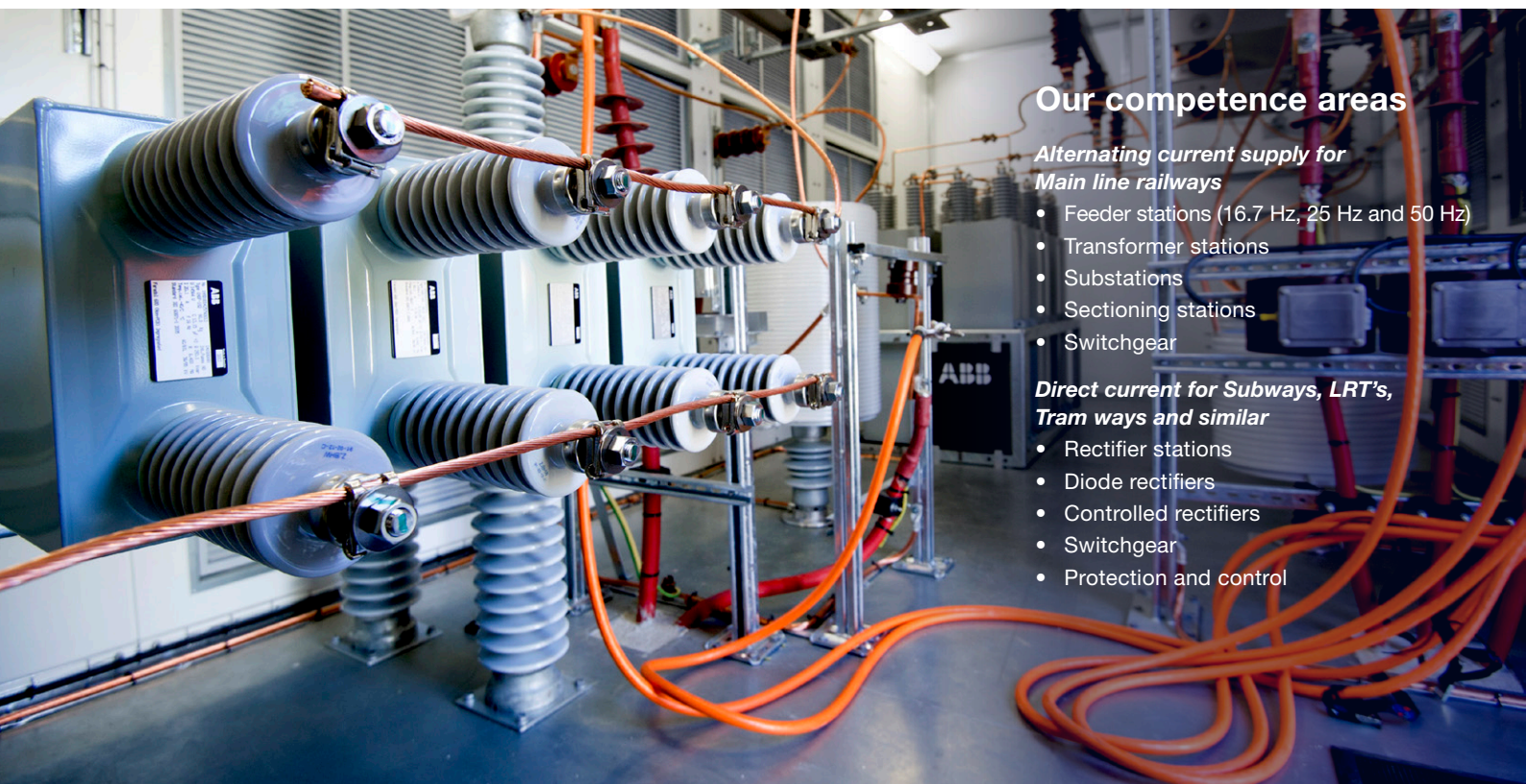




Strukton
Rail

Business Area Power Supply





Our competence areas

Alternating current supply for Main line railways

- Feeder stations (16.7 Hz, 25 Hz and 50 Hz)
- Transformer stations
- Substations
- Sectioning stations
- Switchgear

Direct current for Subways, LRT's, Tram ways and similar

- Rectifier stations
- Diode rectifiers
- Controlled rectifiers
- Switchgear
- Protection and control

A powerful offer

Today's rail transport, with faster and more powerful trains and increased train services, increase the demands on rail infrastructure. With more than 100 years of experience and highly specialised competence the Strukton Rail Power Supply business area offers reliable and cost-efficient power supply systems for railways.

Faster trains mean a cubic increase in railway energy consumption. Trains that travel twice as fast result in an eightfold increase in demand for electric power. Increased train services also affect power requirements, as does the fact that today's trains have both higher acceleration and deceleration rates. This requires more powerful power supply systems to ensure robust and reliable train services.

100 years of experience and comprehensive expertise

The company's competence in providing power supply systems dates back to the electrification of Malmбанan in 1915. Since then Strukton Rail Power Supply – with its origins in ASEA, ABB, Adtranz and Balfour Beatty Rail – has delivered complete systems for supply of electric power to rail transport systems, throughout the world. This includes providing the majority of feeder stations for the railways in Sweden and Norway, as well as a large number of deliveries to Malaysia, Korea, Turkey and the USA.

Our strength lies in our unique leading-edge ability to design and deliver power supply systems, based on our competence in mechanical, electrical and systems engineering. Our engineers have in-depth knowledge of the products/systems we design and deliver – an experience that has been gained, inherited and managed over an entire century. Another advantage is our wide network of excellent and experienced suppliers and subcontractors. Altogether this is something our customers appreciate and often value higher than a low price.

A complete power package – from analysis to fault correction

Based on the customer's specifications, we design and supply systems that fulfil all functional and performance requirements. We have the capacity to supply complete turnkey installations, and over the years we have actively, and at the forefront, contributed to the technological development within the area.

Our after-sales unit has experience of almost all installations of the Swedish Transport Administration (Trafikverket), including equipment from the oldest installations to the latest technologies. Due to our extensive experience we can offer both innovative solutions for upgrades, fault tracing/correcting and maintenance, for old and new installations.

The older installations often lack spare parts – not least for computer and control systems that are no longer manufactured or in stock. Our knowledge of how the systems function, new functional and other requirements that need to be met, enable us to provide solutions to most of the customer's problems. This includes rectifying problems with static frequency converters from other suppliers.

In addition, we provide advanced technology solutions for electrical measurements and analysis, system studies and simulations, using our in house simulation software. This includes study of electrical interference and simulations/calculations for deciding required capacity.

With our in house simulation software we can perform advanced system studies and simulations. Trains are modelled as dynamic loads that move through the

electrified railway system, accelerating, coasting and braking according to the scheduled timetable, considering track alignment, etc. Different traffic patterns are simulated to determine where feeder stations need to be located and what capacity is required to ensure reliable train operation.

The modular concept – a solution with great advantages

To provide trains with electric power, converter stations are located at intervals along the railway. Converter stations transform the three-phase 50 Hz alternating current from the power grid into single phase 16.7 Hz alternating current. The power is then fed to the overhead contact system that distributes the power to the trains.

Strukton Rail has developed a modular converter station concept. This concept shortens the delivery time by up

to 50 percent, and reduces cost by around 15 percent compared to traditional on-site built converter stations. The modular concept also includes a mobile concept. A mobile converter station can be decommissioned, moved and recommissioned at a new location in just two weeks. This allows situations of urgent power shortage to be permanently or temporarily fixed in an extremely short time. The modular concept is scalable, as modules with additional converters, switchgear for feeding of additional tracks/lines can be added. The equipment in these stations comprises a number of modules, such as high voltage switchgears, transformers, converters one phase switchgear, control and filter equipment.

The modules are prefabricated, with functional testing and quality controls performed at the Strukton Rail



workshop in Västerås. The modules are then delivered and lifted onto foundations on-site. After connecting the modules to each other by prefabricated cables, final tests are performed and the stations are ready for operation. The more that can be done in the workshop under controlled environmental conditions the better, resulting in better quality, shorter time on-site and lower costs.

Sustainable leading-edge technology solutions

Strukton Rail works actively to achieve sustainable development. By maintaining our leading-edge in technology we can provide cost efficient and sustainable solutions to our customers, especially where the environmental impact must be minimised.

The new modular stations often replace older installations with rotating converters (motor-generator units)

and therefore save energy through substantially lower losses. The concept of mobile converter stations is a sustainable solution, as less material is needed and the stations can easily be re-located if required.

Strukton Rail also has its own in house technology using voltage controlled rectifiers with energy recovery, for power supply of DC-electrified rail systems. This type of system is installed on three lines at the subway in Busan in South Korea. When the trains brake electro-dynamically the energy is recovered and fed back to the medium voltage network, for use by other consumers. The controlled voltage regulation also means that the number of rectifier stations can be reduced by 20-30 percent in comparison to conventional rectifier stations with diode rectifiers. This in itself means less impact on the environment.



Reference projects

Electrification of the railway in Malaysia, Ipoh – Padang Besar for KTMB

This project comprised design and delivery of eight complete feeder stations and eleven sectioning stations, as well as system studies of the single-phase 25 kV, 50 Hz railway system and the impact for feeding the 132 kV power grid.

The Swedish project was part of a larger project where the railway track from Ipoh to Padang Besar was to be double tracked and electrified. Balfour Beatty Rail Malaysia formed a joint venture company (JV), together with Ansaldo Signal, supplying the complete systems covering feeder stations, sectioning stations, overhead contact system, signal and telecommunication systems.

Swedish contract value: 320 MSEK. Period: 2009–2013.

Stavanger converter station, Jernbaneverket, Norway

The project comprised design and delivery of a complete, turnkey converter station with two 10 MVA converters for 15 kV, 16.7 Hz traction power supply.

To enhance the power supply to the railway, a new converter station was built in Stavanger. Strukton Rail had a turnkey contract for the converter station, which meant full functional responsibility for the entire converter station, its performance and its fulfilment of customer requirements.

Contract value: 140 MSEK. Period: 2009–2011.

Kalix converter station, Swedish Transport Administration (Trafikverket)

The project comprised design and delivery of a complete, turnkey converter station with two 15 MVA converters for 15 kV, 16.7 Hz traction power supply.

For traction power supply to the new Haparandabanan a new converter station in Kalix was required. A turnkey contract for the converter station meant full functional responsibility for the entire converter station, its performance and its fulfilment of customer requirements.

Contract value: 140 MSEK. Period: 2010–2014.

Mobile converter stations, Norway

The project comprised design and delivery of five complete, turnkey mobile converter stations, each with one 15 MVA converter for 15 kV, 16.7 Hz traction power supply.

Due to increased services with more powerful trains, the railways in Oslo are in urgent need of more power. With the mobile concept the delivery time is around ten months shorter than for on-site built converter stations, and at around 15 percent lower cost.

Contract value: 250 MSEK. Period: 2012–2015.

Norrköping rectifier stations

The project comprised design and delivery of eight complete rectifier stations and SCADA-system for traction power supply for the tramlines in Norrköping.

Norrköping Municipality modernised the tram lines with a new tram line including power supply, Hagebylinjen. Strukton Rail designed and delivered prefabricated, container-based rectifier stations, as well as a monitoring system (SCADA) for the remote control centre.

Contract value: 30 MSEK. Period: 2008–2011.

Support agreement with the Swedish Transport Administration (Trafikverket)

In January 2014 our after-sales unit signed a contract with the Swedish Transport Administration (Trafikverket) to provide support for their entire population of static frequency converters. The agreement covers 3+3 years and comprises call-out services, for example to perform fault tracing, corrective maintenance, investigations and monitoring.

More references

- Converter stations with static frequency converters – 20 in total supplied to Sweden, Norway and the USA.
- Refurbishment of existing converter stations in Ösmo, Nyköping, Gällivare, etc. in Sweden.
- Converter stations with rotating converters in Emmaboda, Mjölby and Kiruna, in Sweden.
- Complete tramway systems in Istanbul, Izmir, Adana and Eskisehir in Turkey.
- Controlled rectifiers on Nockebybanan and Roslagsbanan in Sweden, lines 1, 2 and 3 for the subway in Busan, South Korea and in Dallas, USA.



Norway, mobile converter stations



Malaysia, electrification of the railway Ipoh-Pedang Besar





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Rail

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Strukton Rail builds, operates and maintains the infrastructure of several of Sweden's major railway lines. In Stockholm we are responsible for maintaining the underground and the Roslagsbanan.

In 2014 Strukton Rail acquired the Balfour Beatty Rail Scandinavian operations, including the business area Power Supply. This business area has its headquarters in Västerås, Sweden and employs just over 20 people. Through the merging of the two companies a leading Nordic privately owned railway contractor was established, with comprehensive competence and capacity within most of the railway technologies, such as, track works, electrification including feeder stations, signalling and telecommunication.

Strukton Rail contributes to railway facilities maintaining a high standard and meeting the needs of a growing population – today and in the future.