SMA provides auxiliary power supplies for a total of 55 commuter trains for Storstockholm Lokaltrafik (SL). They are manufactured by ALSTOM LHB in Salzgitter and belong to the family of regional commuter trains CORADIA™.
Innovative, redundant auxiliary power supply for sophisticated commuter trains

The auxiliary power supply for CORADIA LIREX™ for Storstockholms Lokaltrafik (SL) belongs to SMA’s product family MEE-NTSD (SD = Short Distance) for regional trains and is based on the MEE-NT platform. SMA has thus an innovative and sophisticated modular platform proven in daily use for auxiliary power supplies in different applications.

Redundancy Concept

All converters of the auxiliary power supply in the CORADIA LIREX™ for SL operate in parallel. In case of a failure within a device, this device is switched off and disconnected while all other devices continue operation. The supply of the train is not interrupted.

Design

The auxiliary power supply is powered with an input voltage between 900 and 1,800 V DC from the DC link of the traction converters. Operation at 1 kV AC or via a workshop supply with 3 x 400 V AC is provided as well. The auxiliary power supply system consists of the function units indicated below:

- high-voltage input converter
- 3-phase output inverter
- battery charger
- 3-phase battery inverter

Additional functional components, such as coupling contactors, fuses or emergency start-up batteries, are already integrated into the auxiliary power supply.

The high-voltage input converter features two compact and lightweight electronic modules with appropriate inductive components. This converter generates a train-wide, electrically separated DC link of +/- 400 V DC out of the different input voltages. The output inverters and battery chargers are connected to this DC link. Each input converter has a nominal power of 125 kW. Due to parallel operation, a total power of 250 kW is available at the DC link. In case an
input converter fails the train-wide DC power available is reduced to 125 kW resulting in continued train operation with reduced air conditioning.

Each battery charger features a battery charging control with temperature compensation, a battery current control and an output current limitation. The two battery chargers supply a train-wide 110 V DC line. All DC consumers as well as the battery inverters for emergency operation that are integrated in the auxiliary power supply system are connected to the 110 V DC line. If one battery charger fails the second charger assumes its loads. Unrestricted train operation remains possible.

The 3-phase output inverters with a nominal power of 105 kVA each provide a train-wide 3 x 230 / 400 V AC line. The inverters generate a grounded, load tolerant neutral wire that may be loaded with up to 10 kVA. In case of overload, each output inverter temporarily provides a power of up to 210 kVA. If one output inverter fails the second inverter assumes its loads. Unrestricted train operation remains possible.
Non-welded aluminum enclosures

All roof-mounted enclosures are non-welded aluminum containers making it possible to design ultra-lightweight enclosures. A modular system is also used for the containers allowing to simply adjust them to the vehicle requirements.

Each input converter is installed into a roof-mounted aluminum enclosure together with the integrated input contactors, rectifiers and fuses, emergency starting units, inductive components and the necessary cooling equipment. The container’s total weight is 490 kg.

All output converters are mounted into a second, compact enclosure together with the necessary inductive components (e.g. sinewave filter chokes), the cooling equipment and central control unit with interface to the vehicle bus. The total weight of this container is 530 kg.

In addition to the requirements referring to modularity and noise emission, specifically the ambient conditions in the region of Stockholm (e.g. windblown snow) were considered during development of the enclosure technology (in cooperation with ALSTOM and SL).

Technical Data
(Auxiliary power supply per half-train)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>1.5 kV DC</td>
</tr>
<tr>
<td>DC line</td>
<td>+/- 400 V DC, 125 kW</td>
</tr>
<tr>
<td>AC output</td>
<td>3 x 230 / 400 V, 50 Hz, 105 kVA</td>
</tr>
<tr>
<td>AC overload</td>
<td>210 kVA for up to 60 s</td>
</tr>
<tr>
<td>DC output</td>
<td>110 V DC, 180 A</td>
</tr>
<tr>
<td>AC output emergency inverter</td>
<td>3 x 230 / 400 V, 50 Hz, 7.5 kVA</td>
</tr>
<tr>
<td>Dimensions: 2 containers of resp.</td>
<td>1,800 x 1,200 x 460 (mm)</td>
</tr>
<tr>
<td>Total weight</td>
<td>1,020 kg</td>
</tr>
</tbody>
</table>

Conclusion

SMA’s MEE-NTSD is a sophisticated platform of auxiliary power supplies for short-distance traffic. This auxiliary power supply features power converters operating in parallel for reasons of redundancy. Based on this innovative and trend-setting platform it was possible to develop an ultra-lightweight auxiliary power supply for CORADIA LIREX™ of SL.