SMA provides auxiliary power supplies for a total of 42 three-car metro trains for Metro Kaohsiung. The trains will be used in revenue service in Taiwan as of the beginning of 2007.
Innovative, redundant auxiliary power supply for sophisticated metro trains

The auxiliary power supply for the new metro trains for Metro Kaohsiung belongs to SMA’s product family MEE-NT\textsuperscript{SD} (SD = Short Distance) for regional trains and is based on the platform MEE-NT. SMA has thus an innovative and sophisticated module platform proven in daily use for auxiliary power supplies in different applications.

Integration into vehicle

Each metro train for Kaohsiung consisting of three cars is equipped with 2 identical MEE-NT\textsuperscript{SD} establishing a partly redundant system. The auxiliary power supply is provided with an input voltage of 750 V DC from 3rd rail. If one power supply fails the other MEE-NT\textsuperscript{SD} supplies important consumers. The output and coupling contactors required are integrated into the auxiliary power supply. The two MEE-NT\textsuperscript{SD} are connected in parallel to one single DC board supply and charge a battery.

Design

The auxiliary power supply system consists of the function units indicated below:

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

A number of additional functional components can be integrated into the MEE-NT\textsuperscript{SD}. It is thus possible to simply adjust the system to the diverse requirements of sophisticated metro trains. The MEE-NT\textsuperscript{SD} Kaohsiung is therefore equipped with a high voltage input contactor, output and coupling contactors. An upgrade for an emergency starting unit is available.

For 750 and 1,500 V DC

The high-voltage input converter consists of 2 compact and lightweight electronic modules with associated inductive components. This converter is equipped with two separate outputs. One output is directly used as battery charger while the other generates a DC link in order to supply the output inverters connected.

Due to the input converter’s modular design it is possible to realize auxil-
Primary power supplies for input voltages of 750 V DC and 1,500 V DC, both typical for metro trains. In case of MEE-NTSD Kaohsiung (750 V DC) the two modules of the input converter are connected in parallel, while the modules are connected in series for applications with an input voltage of 1,500 V DC.

Because the battery charger was integrated into the input converter it was possible to reduce dimensions, weight, complexity and costs while maintaining performance.

Inverter with high overload

The 3-phase output inverters with a nominal power of 135 kVA each provide a 3 x 220 / 380 V, 60 Hz, AC board supply. The inverters generate a neutral wire that is grounded in the auxiliary power supply. It is therefore possible to achieve an output voltage quality comparable to the public grid. Other project-specific output voltages and frequencies are possible as well.

Single-phase loads are supplied via an additional transformer. This solution allows the supply of single-phase loads of another voltage level. In case of the Metro Kaohsiung project the single-phase AC voltage output has a nominal voltage of 1 x 110 V AC, 60 Hz.

The air conditioning systems are the main consumers of electric power. Air conditioning requirements are very high in Taiwan. As the air conditioning systems are directly connected to the inverter without unloading or soft start the inverters have been designed with an extremely high overload ability.
Non-welded underfloor containers made of stainless steel

Each MEE-NTSD auxiliary power supply is integrated into one separate underfloor container. A partly redundant double system, as for the Metro Kaohsiung, therefore consists of two separate underfloor containers that can be positioned side by side or underneath different vehicles as well.

The underfloor containers are non-welded enclosures made of stainless steel. This technology makes it possible to design ultra-lightweight enclosures. A modular system is used for the containers as well allowing to simply adjust them to the vehicle requirements.

As for dimensions and weights, new standards are set. An MEE-NTSD auxiliary power supply has a weight of 825 kg to 900 kg according to input voltage and equipment (options, such as contactors or emergency starting units).

In addition to the requirements referring to modularity and noise emission, different ambient conditions were considered in the development of the enclosure technology. Thus, the system can be used worldwide without complex adjustments.

Technical Data

<table>
<thead>
<tr>
<th>Technical data MEE-NTSD (Example)</th>
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</thead>
<tbody>
<tr>
<td><strong>Input voltage</strong></td>
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<tr>
<td><strong>AC output 1</strong></td>
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<tr>
<td><strong>AC output 2</strong></td>
</tr>
<tr>
<td><strong>DC output</strong></td>
</tr>
<tr>
<td><strong>Dimensions of underfloor container</strong></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
</tr>
</tbody>
</table>

Conclusion

SMA’s MEE-NTSD is a sophisticated platform of auxiliary power supplies for short-distance traffic. Based on this innovative and trend-setting platform it was possible to develop a very compact and ultra-lightweight auxiliary power supply for metro applications. Specifically the low system weights of well below 900 kg are an outstanding system feature.