

POWERBOX  
Mastering Power

Transportation  
Railway

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# Railway solutions

## **Power converters for railway applications**

A moving non-controlled environment is a challenge for any electronics. Our power solutions for railway are well prepared for this.

Railway applications can be divided into rolling stock and track side, with the former dividing again into propulsion and car body. Most of them share the combination of higher than normal reliability requirements and a challenging environment. Propulsion system applications are among the most challenging anywhere with regard to the reliability/ environment combination. Powerbox has more than 30 years' experience in designing and delivering power solutions for all types of railway applications. Our customer base is considerable, which has led to an enviable reputation and track record of reliability and our LCC (Life Cycle Cost) is second to none. We work with some of the largest players in the international rail industry - a position of trust we value highly.

## **Rolling stock applications**

- Propulsion systems (IGBT control, brake control, computers)
- Drivers cabin (power displays, communication systems etc.)
- Travelers cabin (AC power for charging, information displays, entertainment systems)
- Bistro (microwaves, coffee machines, cash registers, computers)
- Battery charging and system power generation
- Charging devices for electrical motor start
- Brake magnetizing in towing applications
- Zero volt start applications

## **Signaling and track side applications**

- Level Crossing controls
- Signaling Control Systems

Although much of our experience in the transportation market has been in railway applications, we have also acquired an extensive reputation for providing power into other areas such as automotive, marine and avionics.

## **International standards**

We are experienced at providing products to meet and be approved to relevant railway standards, such as EN50155, EN50121-3-2, EN61373 and EN45545, in addition to more localized standards.

# Railway solutions

## Standard products

Our extensive range of standard converters, for railway applications, comprises of both our own products, designed by our engineers and manufactured at world class manufacturing facilities, as well as products from our leading product partners. After working in the rail markets for 30+ years chances are good we have a standard power supply to meet your needs.

## Custom products

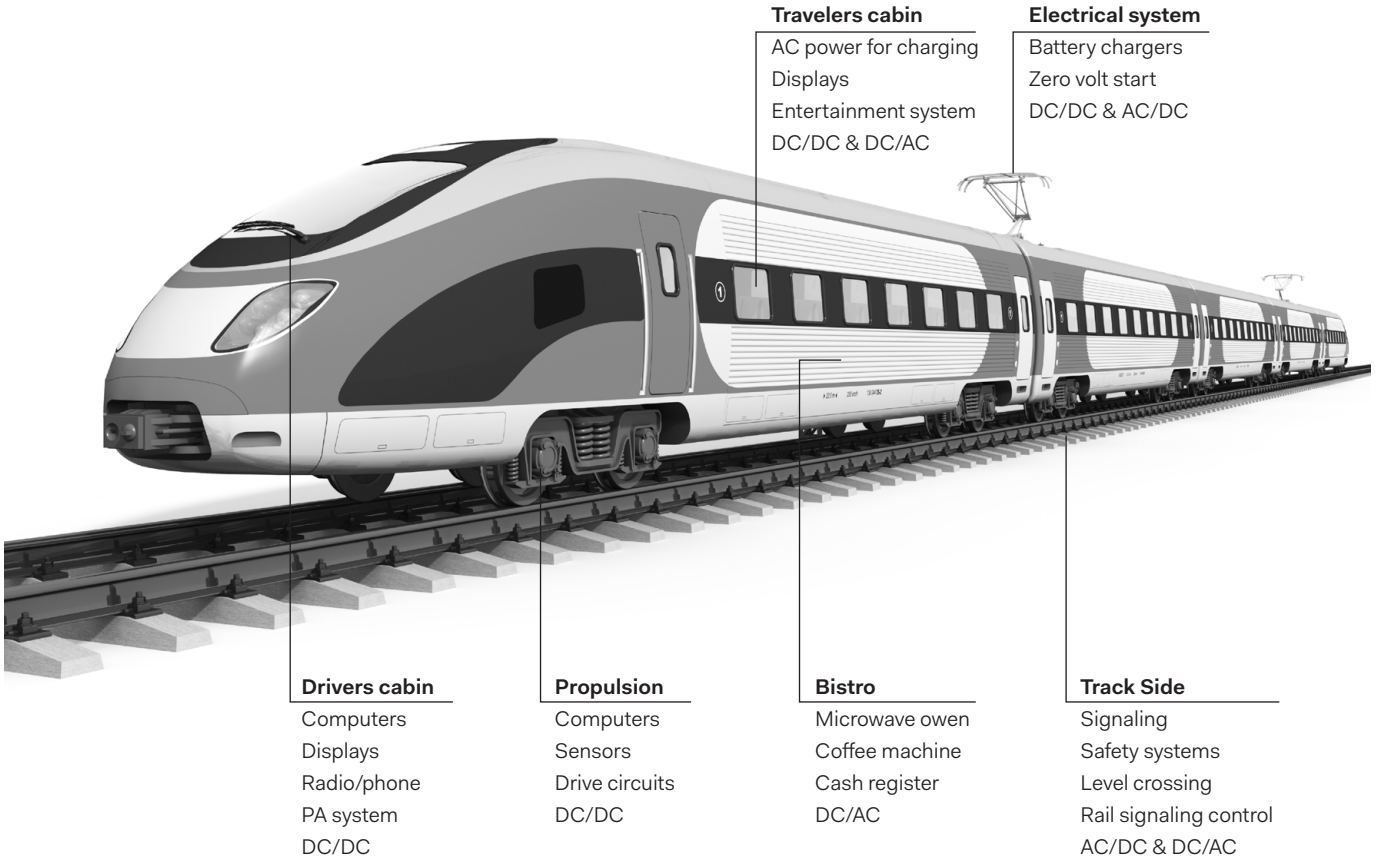
If a suitable product cannot be found from our standard product range, we can consider providing modified standard, semi or full custom solutions. Our custom design capability and reputation is second to none. We have completed more than 2,500 custom design projects to date, whereof 1,350 at our Gnesta, Sweden, design center.

## Services

The right product is essential, but it is not everything. In addition to product offerings we include a comprehensive range of services, from analysis and qualification in the development stage, demand planning and special logistics in the production phase, to RMA handling and end user support in the after-market. We aim to serve you with simplicity to ensure your customers return time and again.

## Systems

An application might require more than a single converter. We then use our product range and our custom capability to build systems. These can feature multiple standard, semi-custom, and/or full-custom converters, battery backup, communications, remote control, intelligent charging, distribution panels, sub racks, enclosure etc., and maybe also a number of value-added services. We lean confidently on over 40 years of experience and subject matter expertise to identify the best means of solving every particular power conversion challenge. Together with our customers we find the optimized solution.



# Standard products – Railway line



**Railway line 20 and 40**  
**ENAR20W Series**  
**ENAR40W Series**  
 20W or 40W  
 4:1 inputs for all EN55150 voltages  
 DC/DC converter"



**Railway line 150**  
**ENR150D Series**  
 150W, 24V or 110V input  
 2x24V or 2x12V output  
 DC/DC converter



**Railway line 200**  
**ENR200D Series**  
 200W, 24V or 110V input  
 3x24V output  
 DC/DC converter



**Railway line 600**  
**ENR600 Series**  
 300-500W  
 DC/DC converter



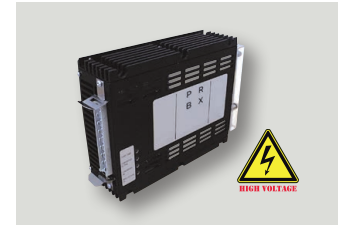
**Railway line 2300**  
**ENR2300I Series**  
 2300VA  
 110V input, 230VAC output  
 DC/AC inverter



**Railway line 10000**  
**ENR10000 Series**  
 2-30kW, 20-150VDC  
 Battery charger



**Railway line 280**  
**ENR280D1500110 Series**  
 280W, 1500/110V  
 DC/DC converter



**Railway line 280**  
**ENR280D750 Series**  
 280W, 750/24V or 750/110V  
 DC/DC converter



**PAF(D)150 Series**  
 150W  
 4:1 inputs for all EN55150 voltages  
 DC/DC converter



**T8, T8W, PMR20 or PED40W**  
**Series**  
 8W in DIP24  
 20W or 40W in 2x1"  
 DC/DC converter



**Railway bricks**  
 50-600W  
 Full, half or quarter  
 DC/DC converter

# Partner standard products

Cosel is one of the world's leading power supply manufacturers offering DC/DC converters utilizing state-of-the-art technologies. Cosel has built up an enviable reputation for high quality products. This is reflected in high MTBF figures and 5 year warranties being offered on their products. Cosel offers extremely high reliability products for harsh and tough environments.



# Custom products

Here are examples of custom products we have provided to railway customers in the past. Powerbox has to date completed more than 2,500 custom design projects.



AC/DC power supply for 200W zero volt start. Designed for undercarriage mounting.



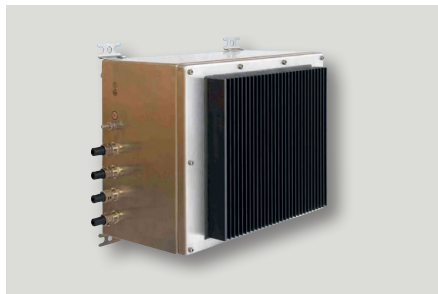
AC/DC converter for feeding of motor management of a diesel locomotive.



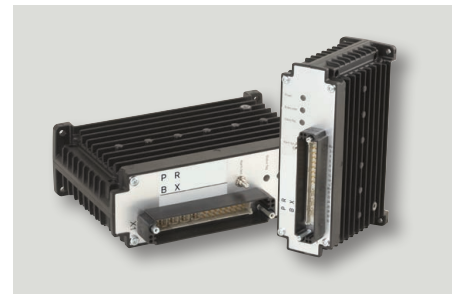
DC/DC power converters for magnetizing and charging application. 400VDC output.



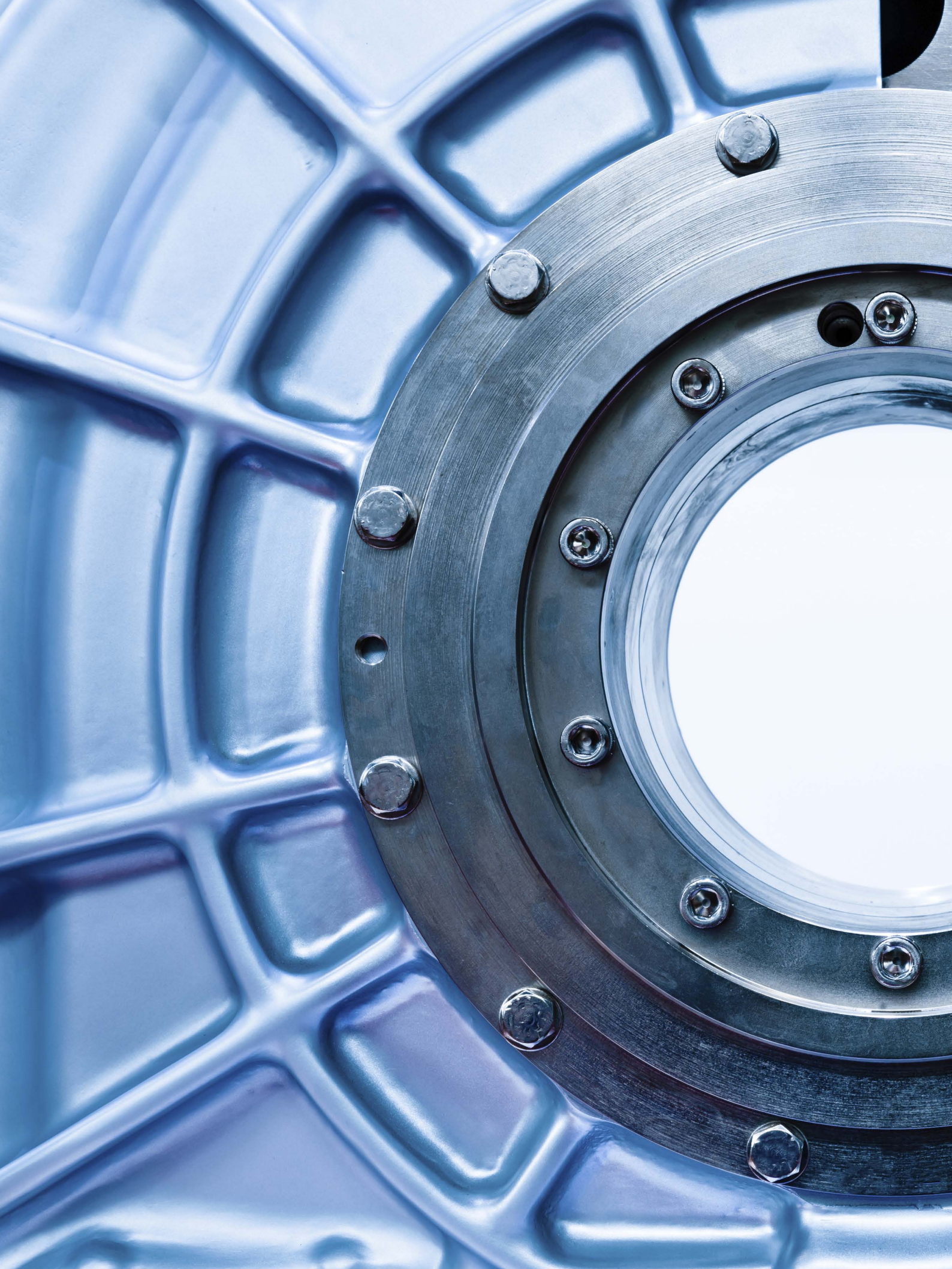
DC/DC power supply family for train propulsion system and other on-board applications. 24-110VDC input, 3x24VDC output, 190-250W.



2kW DC/DC converter with IEC61373 and EN50155 approval. For undercarriage mounting.



Brake interface. For retrofit in different rail vehicles to adapt correct voltages and current levels when integrating new systems.





# Power solutions examples

## **Re-design of propulsion system**

The challenge: It started with an emergency call from one of our customers. At the first tests of a complete new vehicle the propulsion system stopped randomly, and a Powerbox DC/DC converter was initially suspected to be the cause.

The solution: A Powerbox investigative team was on site the following day, carrying out practical tests and measurements as well as theoretical analysis. The cause was found to be in a subsystem powered from the converter. In certain operational modes this subsystem caused severe overload on the converter, way outside of the design parameters. Our team proposed a solution, by means of a re-design in the subsystem. This was implemented and the project kept on schedule.

Added value: What started off as a warranty complaint changed into electrical design consultancy. This is not an activity we promote, but knowing the expertise is there is comforting – to us and our customers.

## **System solution to solve noise and transients beyond EN50155/EN50121-3-2**

The challenge: A regular customer of ours ran into problems during a locomotive retrofit. A battery charger input circuit was failing repeatedly. The cause was identified as a combination of noise from parallel connected devices and transients from pantograph bouncing. The noise and transient levels were way outside of the limits in EN50155 and EN50121-3-2, and more than the battery charger could cope with. Since Powerbox was recognized as railway power supply experts by the customer, we were asked for our suggestions on possible solutions to the problem.

The solution: It was jointly decided, between the customer and Powerbox, that filtering was the most expedient way to proceed and within three weeks we had designed and built an external low pass filter reducing noise and transients to the recommended levels, thereby protecting the battery charger.

Added value: The problem was solved and delays in the locomotive refit avoided. This was also both simpler and considerably cheaper than replacing or redesigning the existing battery charger.

## **Converter request resulting in system optimization**

The challenge: The required task was to power signaling equipment at a large number of remote track-side installations. The input voltage provided was AC mains and the required output was a variety of DC voltages, depending on the equipment present at each respective site. Battery back-up was also requested. As most installations were in cabinets with limited thermal management capacity minimized heat dissipation was critical. A large number of remote sites meant reliability was an essential re-requisite, which required for a short MTTR (Mean Time To Repair).

The solution: Powerbox was initially invited to supply a DC/DC converter for this application. As we analyzed the application we saw the potential for considerable cost savings in several other areas, by applying lean design and a modular concept. The customer agreed to our proposals and the initial DC/DC invitation was transformed into a custom system order. Powerbox designed a modular power system with integrated power conversion, battery charging, distribution panel and a computer interface for communication. High efficiency converters and smart system architecture reduced heat dissipation.

Added value: The modular concept enabled standardization of the power solution for a large number of installations with different configurations. This standardization reduced the total system cost at the same time as it facilitated more effective planning. The modular design, with its potential 'swap repair' capability, also had additional benefits of shortening potential repair times and significantly improving the efficiency of managing spare parts maintenance.

# About Powerbox

## **Who we are**

The combination of our extensive standard product range, our custom design capability, and our service offering, is truly unique. 40+ years of designing power supplies for demanding applications, whereof 30+ years in the Railway industries, has built a rock solid experience. Our "Making the complex simple" business idea runs throughout our operation, from our customer interface and cooperation to how we design our products.

## **Improving your competitiveness**

The power solution chosen for any electronics has an impact on competitiveness. Function and reliability are given basics. Size, weight and audible noise might be important. Cost is always a consideration. Standards fulfillment can open up new markets. Time to market might be critical. Well executed supply chain management can generate savings. Aftermarket support has a lasting long term impact. The list goes on.

Our extensive experience and market awareness makes it simple to explain to us what you need. Together we define which power solution will serve your application the best. This close cooperation continues from conception and design, throughout production and taking into operation, well into the aftermarket phases of your product life-cycle. We contribute to your competitiveness all the way.

## **Making the complex simple**

With our global presence we are close to you, and our knowledge and experience of working with so many different applications helps to make life easier for you. We can assist at all stages of product development, including evaluations, validations, and the writing of specifications.

We aim for simplicity in design, referring both to lean design with fewer components and to a modular approach reusing proven circuits and building blocks, maybe with some modifications.

Our services for logistics, implementation and aftermarket support makes life simpler both for you and for your customers, and our endurance makes sure it stays that way.

## **Quality assurance and follow-up**

Quality is an integrated part of everything we do. Our design process includes extensive testing, internal as well as external. Tests are also frequently run by our customers in their respective applications. In addition to the information we gain by tracking repairs and service requests, we also do regular quality follow up together with our customers, all to ensure a long and trouble-free life for our products.

Powerbox is also certified by DNV according to ISO 9001:2008.

## **Manufacturing**

We manufacture at selected CEMs (Contract Equipment Manufacturer), where we apply rigorous process and quality requirements. We aim for long-term relationship with our manufacturing partners. A dedicated team for CEM Management and Quality Assurance work closely with them. Both when selecting a new partner and in the ongoing relationship with our existing partners we evaluate a large number of parameters, covering company profile, organization, manufacturing processes, and quality assurance.

## **Caring for the environment**

At Powerbox we take an active role in protecting our environment. Our contribution includes: Streamlined solutions and lean design using fewer components reduces material used. RoHS, WEEE and REACH are among the standards governing choice of materials.

High efficiency reduces energy consumption both directly by reducing losses and indirectly by reducing the need for cooling.

Energy efficient transportation and well developed use of online meetings are important elements in our determination to meet or exceed international standards by sustaining ISO-14001 compliance or the equivalent.

## **Providing peace of mind**

Even the best designed power solutions might require midlife support. Components involved in the design might be discontinued, or the application might be modified or changed, requiring changes in the power solution. In situations like this Powerbox' stability and endurance, and long term approach to customer relations, are true comforts.

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