1/2007

POWERBOX

Journal

world class manufacturer of power supplies

How to stay cool

Thermal aspects on power supplies

Shape

An unexplored aspect of power supplies

Powering the new generation of aircraft cabins

powerbox

Constant change

Most of the articles in this issue of Powerbox Journal describe change. It spans from entering new industries, via finding new ways to support our customers, to responding to changing requirements and regulations.

We meet world renowned industrial designer Ulf Hanses who assist us in bringing the dimension of industrial design into power supplies. This enables us to offer our customers power supplies harmonizing with the design profile of their application, thereby enhancing their visual branding.

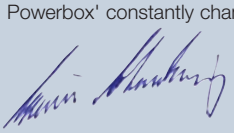
A stop in Holland to visit Antoine Romme and his Powerbox Benelux team not only introduce us to our new office in Breda and additional resources. It also illustrates how new possibilities, opened up by the expanding European Union, can be used to make more resources readily available to our customers.

On the application side we visit Crane Aerospace & Electronics, who with their P.L. Porter brand is a world leader in, among other things, airline seating. As advanced seat control now is going electronic this is a new application for power supplies. The technical requirements for airliners and the expectations of premium class passengers combine to create a very challenging application. Dan Ulate at Crane shares some thoughts on this business, and on Crane's cooperation with Powerbox. We also get an introduction to our recently launched Medline, a new program of medical approved power supplies with some unique features in power density and packaging.

The technical section addresses two changing areas. One is the thermal aspect of power supplies, where demand for smaller dimensions and constantly increasing heat density are the drivers. The other is hazardous materials where the need to look after our environment, as driven by RohS and WEEE directives, forces us to find new ways.

The visit with Stefan Altaker at the Powerbox European service centre rounds off by describing something not changing – our strive to offer our customers top class products, with top class support.

I wish you enjoyable reading, looking into Powerbox' constantly changing world.



Louis Masreliez
President
Business Area Powerbox

YOUR DEPENDABLE POWER PARTNER
Close to you!

The product portfolio architect

Raised by

Meeting above-average technical requirements in a cost efficient way is the key to continued growth for Powerbox® Business Unit Standard Power, says Anders Arvidsson, manager of the Business Unit. The salesman turned product manager is taking his lead from the customers when guiding the expansion of the product range.

Standard Power has been a part of Powerbox from the very beginning, more than 30 years ago. What started with laboratory power supplies and industrial DC/DC converters has evolved into an expansive business targeting challenging applications in a number of high-profile industries. Anders Arvidsson has headed Standard Power since 1998. Here he talks to us about this Business Unit, as he sees it.

Targeting tough applications

When asked to describe his operation, Anders first points out the strategic direction: “Standard products are by definition products where several customers and applications share similar requirements. This can be in dimensions, technical data etc. But for us it does not have to be at the top of the global volume list. The real high volume standard power supplies are typically designed to meet rather average requirements. Powerbox is targeting areas where the requirements are somewhat tougher. Call it a niche strategy if you like.”

Anders then hints at what he considers to be one of these niches. “Looking at the global offering of standard power supplies there are plenty of average quality units with limited features, as well as high quality in combination with all the bells and whistles”, he says. “High quality in combination with low or average feature content is one of the profiles we have found a substantial need for, and of course our strong in-house design capacity is helping us in satisfying this need”.

Strong presence in Medical

When asked if there are any particular industries Powerbox is targeting Anders hesitates a while. “We are very strong in Medical”, he starts. “Automotive and to some degree Avionics are other strong areas, but this is not because we target these industries as such. It is a consequence of their requirements. These three industries require a little extra in areas like personnel safety, withstanding vibration, and reliability. Our ability to meet these requirements form the basis for this business. By working in industries as these three we constantly learn more in their critical areas, which we make good use of also in other industries. Broadcasting, Military, and high-end industry applications are examples of other areas where we are expanding.”

On the question of any particular ability or asset enabling Powerbox to meet more demanding requirements Anders first points to the design tradition within the company. “The world is full of designers and suppliers capable of meeting tough requirements, as long as money is no option”, he says, “but to do it in a cost efficient way requires substantial experience

his customers

Anders Arvidsson and industrial designer Ulf Hanses reviewing the Medline EXM80 design. Read more about the new Medline external power supply and its designer on page 10 and 14.

and a corporate culture where demanding requirements have been in focus for a long time". After elaborating a while on company culture he points at one major contributor. "I believe component lean design is a major contributor. It has a very obvious and substantial impact on both reliability and cost, and brings advantages also in other areas".

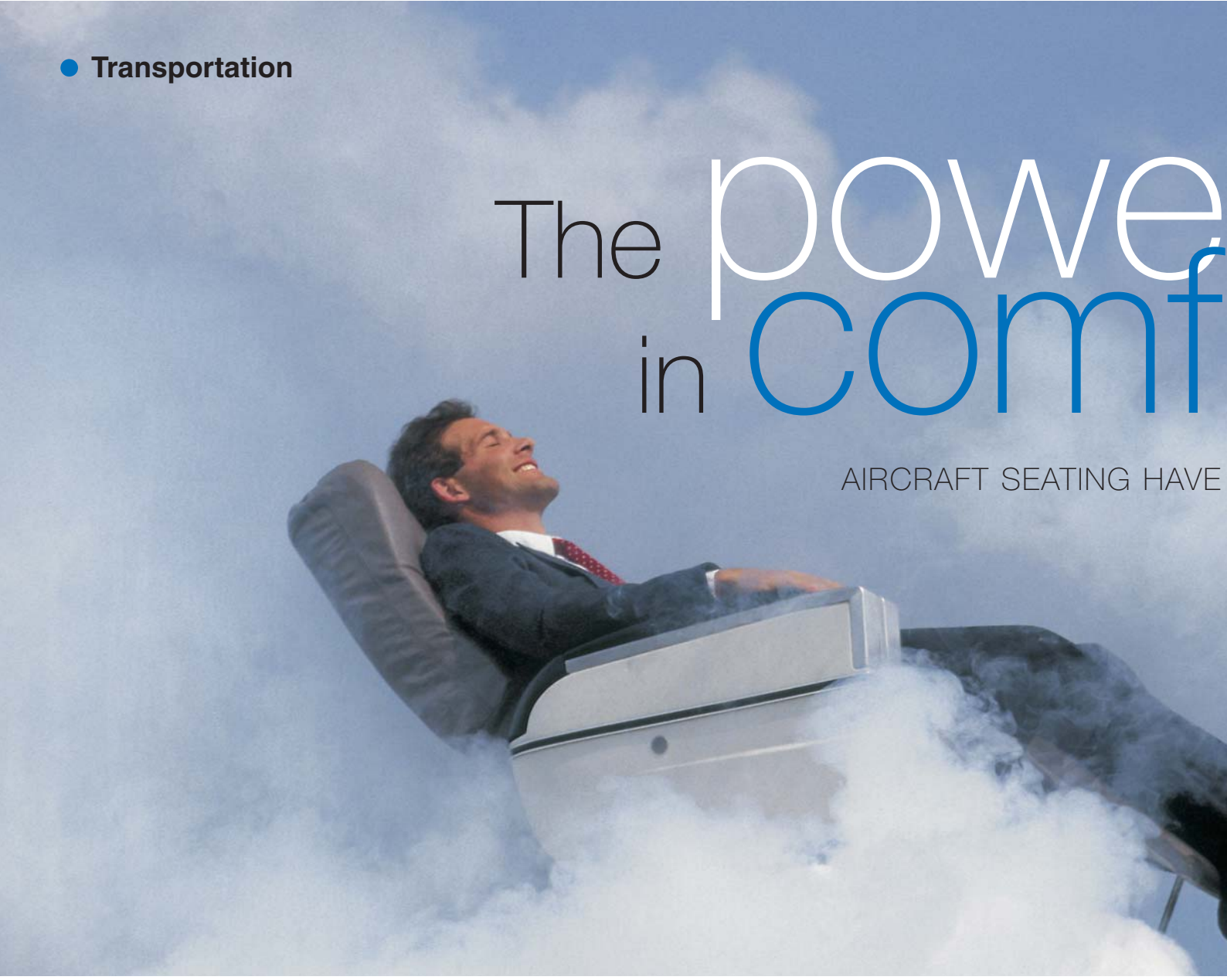
Finding the perfect standard

When asked which aspect of his job he finds most satisfying Anders points to what he feels is the key difference between standard and custom. "In many ways standard and custom power supplies are like ready-made and tailor-made suits. Custom is like tailor-made. You talk to the customer to learn his preferences. You take all his measurements. Then it is down to craftsmanship and technical skill. The same craftsmanship and skills are equally important for standard, but before applying them you have to decide on a product profile and specification, creating a close to perfect fit for several customers. A main challenge for building a successful standard line is in product management, and this is what I enjoy the most. Finding the perfect match between the requirements of a certain group of customers, and the abilities of Powerbox. If you have ever tried on a ready-made suit, experiencing the feeling it is tailor-made for you, you know what I mean. This is what I want to accomplish for our customers."

Focusing on customer contacts

"My career in this industry started close to the customers and evolved later to the product offering", says Anders when prompted to talk about his background. "During my first stint in the power industry I was in Sales, with among other companies Powerbox. I then tried the sales side of the IT-security industry for a few years. When I in 1998 returned to power, and management of Powerbox' standard power portfolio, my way of thinking was focused on the customers and their needs as the starting point of everything. I hope I have been able to preserve this". Technology for technology's sake does not score big in Anders' book. Technology creating customer advantages does. In line with this thinking he cherishes direct meetings with customers. "Talking to customers and hearing about their needs and wishes is the single most important input in my job. Many other things are important in order to get things done, but no-one is better than the customers when it comes to telling us what they want".

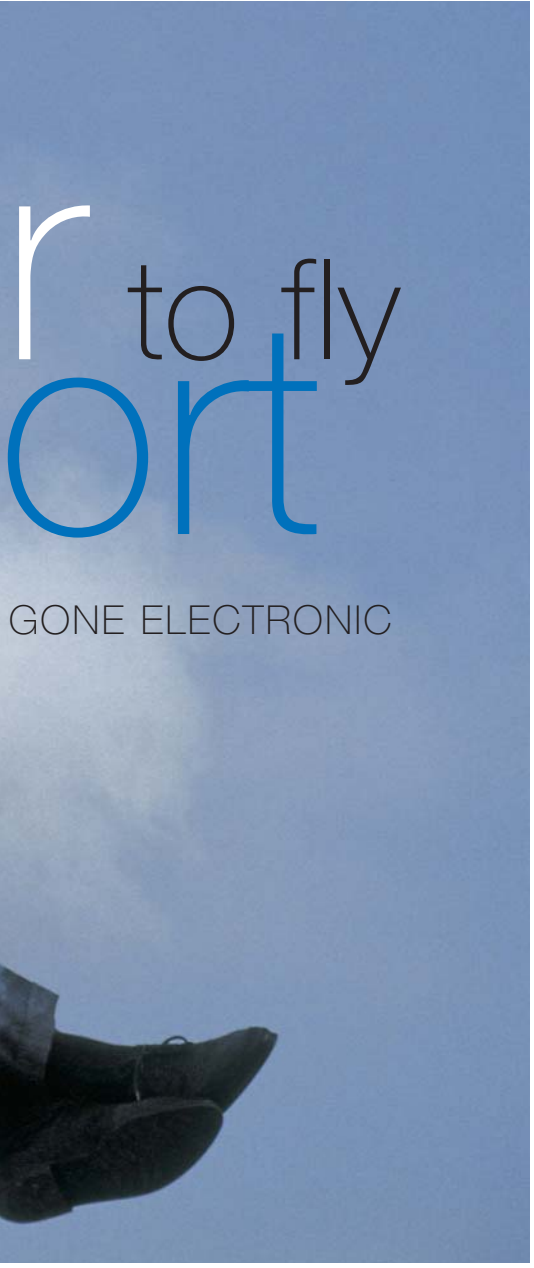
Talking about the future Anders has no hesitations. "We are on the right track. Packaging Powerbox' strengths in standard packages for demanding applications is the direction we have chosen. It looks very promising this far and I really look forward to the years in front of us. This is fun!"



The powe in comf

AIRCRAFT SEATING HAVE

Most of us are familiar with the situation when we are seated in an airliner just before take-off or landing, and the crew instructs us to switch off all electronic devices and adjust our seat to an upright position. If we are in a business or first class seat there is a strong possibility the system we use to adjust the seat is powered by Powerbox.



r to fly ort

GONE ELECTRONIC

> A passenger's satisfaction with the seat has an impact on his or her opinion of the airline. The performance of our product has customer satisfaction impact throughout this chain. Safeguarding the performance is therefore vital to us, and something we spend a lot of energy doing

Crane Aerospace & Electronics, through its P.L. Porter brand, is the global leader in positioning control devices and adjusting technology for aircraft seating and other aircraft cabin applications. They pioneered the first hydraulic aircraft seat reclining devise in the 1940's, and have been in the forefront ever since. Their latest development in this area is the iMotion®, a computer controlled electronic seat actuation and comfort control system for first and business class seating. The iMotion is equipped with a Powerbox power supply.

A high requirement environment

Everybody is aware an aircraft is a high requirement environment, for very obvious reasons. But seat adjustment is not really critical for air safety, is it? So how tough are the requirements? To get an insight into what an application like this takes we talk to Dan Ulate, Procurement Specialist at Crane Aerospace & Electronics. He explains about requirements driven both by air safety factors and by user demand. On the technical side there are a number of regulations for the aircraft industry, and then the larger manufacturers have their own additional requirements. RTCA DO-160, environmental conditions and test procedures for airborne equipment, is the regulatory foundation for a product like the power supply in iMotion. Stricter EMC requirements and a total ban on PVC in all components are examples of differences compared to what is the norm for applications on the ground. And although being able to adjust the seat is not critical for air safety, the seat control system not interfering with other functions onboard is. Just about everybody onboard will use this electronic system at the very moment when the captain demands all electronic devices to be switched off. It better live up to the requirements!

Demanding users

The P.L. Porter iMotion system is installed in both commercial and business aircraft. By far, most of the products end up installed in Boeing and Airbus commercial aircraft. Imagine all first and business class passengers in Boeing and Airbus aircraft. Now, there is a demanding user group. Aircraft seats, especially in first and business class, are very much about comfort. These passengers pay a premium for comfort, and they are perhaps not the most forgiving customer group if any part of that comfort fails. This is important to Crane. Dan Ulate explains;

"Crane's direct customers are the seat manufacturers, who in turn sell the seats to the aircraft manufacturers. A passenger's satisfaction with the seat has an impact on his or her opinion of the airline. The same goes for airlines versus the aircraft manufacturers, them versus the seat manufacturers, and them versus us. The performance of our product has customer satisfaction impact throughout this chain. Safeguarding the performance is therefore vital to us, and something we spend a lot of energy doing. One very important factor here is vendor selection".

Dan Ulate, Procurement Specialist at Crane Aerospace & Electronics

> We of course look at performance and price. On-time delivery is another important factor. I am sure you can imagine the consequences if we should delay delivery of the seats for an otherwise completed aircraft

Vendor selection is major contributor

Since the company's beginning in 1947, P.L. Porter products have provided "Quality with pride". This, together with the established need for very reliable operation, makes it obvious reliability and quality aspects are high on the agenda when they select vendors. But they look for much more. Back to Dan Ulate;

"We of course look at performance and price. On-time delivery is another important factor. I am sure you can imagine the consequences if we should delay delivery of the seats for an otherwise completed aircraft, and neither us nor our customers are willing to keep sizable buffer stocks to cover for poor delivery precision."

Asked about the most important factor Dan says:

"All the factors we have talked about are important, but if I should pick a number one it has to be customer service. There are events in all stages of a products life-cycle, as design, production, and operation, when we need our suppliers support. To get this in a timely and professional fashion is crucial."

Developing relationship

Powerbox' first involvement with P.L. Porter products was modifying a third party power supply for an existing application. From there the relationship has developed and the current iMotion power supply is the first full custom design Powerbox has developed for Crane.

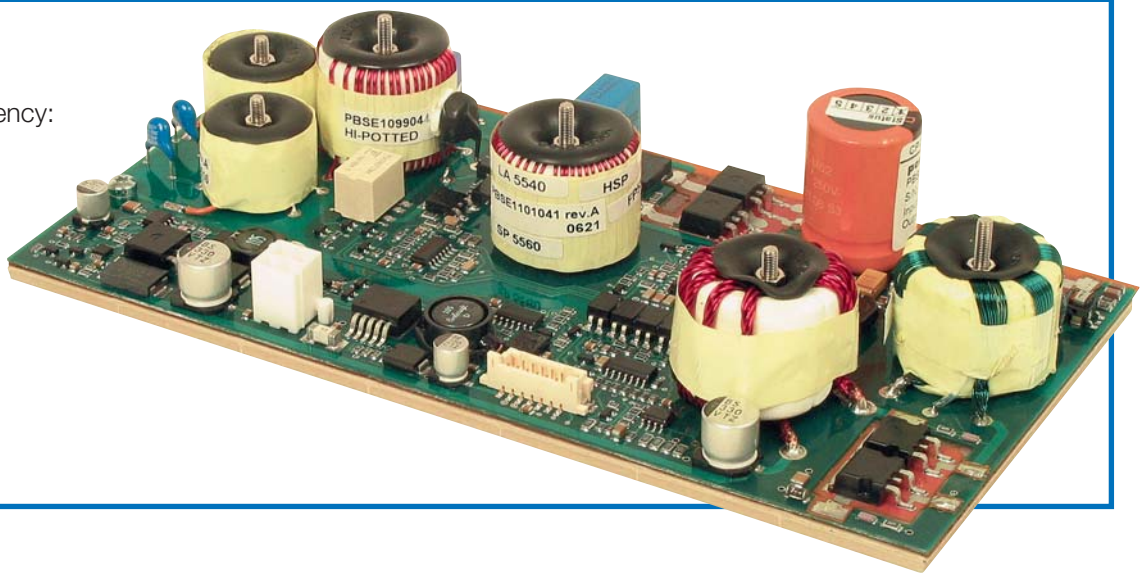
Asked about future cooperation Dan Ulate says;

"It is looking very good this far. All aspects have been to our satisfaction. I especially want to highlight the excellent support, both in the design phase and after the product was launched. As I stated earlier this is very important to us. Providing Powerbox keeps their game up, which I hope and believe they will, I look forward to a continued and deepened relationship."

From Powerbox' side we can only agree. Cooperating with Crane in meeting high expectations from demanding customers in a high requirement industry is a challenge we appreciate and enjoy.

FEATURES POWERBOX POWER SUPPLY PBSE1099/1101

- Input voltage and frequency: AC 110VAC 400Hz
- Output voltage: DC 28 and 12V
- Output power: 300W



Keeping it *cool* in the power supply world

As long as the efficiency of a power supply is less than 100% it will generate heat. In order to avoid overheating the heat has to be transported out of the unit. This is a science in itself, having substantial impact on the unit's size, emitted audible noise, service requirements and life expectancy.

The cooling process for all electronics is in two steps. First the heat has to be transferred from the component where it is generated to some medium for transportation. Then it is to be transported out of the unit. The by far most common method is using air to transport the heat to the air in the surrounding room, but there are also other methods. One such example is using a liquid together with a heat exchanger.

NATURAL OR FORCED AIR FLOW

Air can be used either with self convection (also called natural convection) or forced flow. Self convection makes use of the physical fact that air rises when it is heated, as it has lower desnsity the warmer it is. This generates a flow of warm rising air from any heat source, creating an underpreassure drawing cooler air from the surroundings. This flow can be further enhanced by introducing carefully calculated air channels on system level, making use of the chimney effect. With forced air cooling single or multiple fans are used to generate the airflow. The fans can be either built into each unit or on system level.

Forced air cooling offers substantial advantages in size and weight, and is therefor the dominating method especially for units from about 600W and up. The drawbacks are in the fans. One is the noise generated by the fan and the high velocity air flow. How important this is depends on where the units are used. The other drawback is tied to the relatively limited lifespan and low MTBF for the fans. This calls for periodic service and/or automatic supervision of the fans. As the fans are the weakest link, great care when selecting them is important. Plain bearings are to be avoided, in benefit of ball bearings or magnetic bearings. Smart control of the fan, e.g. half speed at lower loads or even shutting the fan off at low load, can add to the life of the fan. However, a fan shall not be shut off for lengthy periods, but as a minimum be “exercised” at regular intervals.

The choice of cooling method is in most cases made based on the application. If a silent and maintenance free product is desired, or for locations with difficult access as high up in masts, natural convection is attractive. If space is premium and access relatively easy, forced cooling is the dominating choice.

DESIGN ASPECTS

The choice of cooling method has vast impact on the design. Other than how tight the components can be packed component location, orientation, and types of heat sink are effected. When designing for self convection the location of each component has to be for optimized airflow. This is to achieve proper cooling for components not directly linked to heat sinks. As example, if heat radiation from a choke increases the temperature on a neighbouring electrolytic capacitor with ten degrees its life is cut in half. As the air with self convection rises vertically, orientation of the equipment is vital.

In a forced air system unit and component orientation and location are less critical, as airflow can be directed to where it is needed. But also here the designers have to be very aware of the airflow, as the higher airspeed might create turbulence and “cooling shadow” on some spots in the units. The shape of the fins on a heat sink is very important. Natural convection is based on laminar airflow where even and smooth surfaces give best performance. With forced cooling turbulent airflow can be used and for instance pin shaped fins be very efficient. Turbulent airflow has a positive effect on the heat removal, but also generates noise which might be annoying in some applications.

ON COMPONENT LEVEL

There are many methods for coupling semiconductors to heat sinks. The most common is to press them together with a metal spring. The big advantage with this is that the spring load is maintained even if the isolation material gives a bit over time. An alternative is to use surface mounted semiconductors in combination with Insulated Metal Substrate (IMS®). In our industry this is used mostly for power modules. For conventional AC power units the method is, at least not yet, not widely used. It offers however several advantages, as easy supervision of the mounting process and physical robustness. Thermal performance is on the same level as conventional mounting. An alternative to IMS for lower power is to use circuit boards with thermal via. This is to transport the heat to the other side of the circuit board via drilled holes filled with tin, and there with a thermally conductive insulator transfer it to a heat sink.

Although there are well established and proven methods for cooling semiconductors, the same is not true for magnetic components as transformers and chokes. The heat generated in these components is low, compared to semiconductors, but the thermal resistance is high which can result in high temperature. If the temperature in a transformer forming part of a safety barrier rises above 100 degrees centigrade (dependent of measuring method) stricter certification requirements come into force. In order to get a UL recognition or listing an approved isolation system has to be used, limiting the freedom in design. One way around this can be to couple the transformer thermally to the heat sink. This can be done, although the large mechanical tolerances and the lack of a flat surface on the winding have to be overcome. If planar transformers are used the heat can be removed via the core. The winding of torroid transformers can also be coupled thermally to a heat sink with relative ease. It is important to use a relatively soft thermal conductor for good coupling to the uneven shape of the winding.

AND MUCH MORE

As stated initially cooling electronics is a science in itself, involving many aspects not mentioned here. One example is the impact of air pressure. For equipment to be operated at high altitude the lower air pressures negative impact on cooling efficiency has to be part of the calculation. Another is the possibility to, for applications with high momentary heat generation but a low average, thermally link the components to a piece of metal with large thermal mass. By this the requirement on thermal resistance in the heat sink is reduced.

The latest development in heat transportation is graphite. Its heat conducting ability is better than cupper or aluminium. A special characteristic of the graphite used is that it is layered and transfers heat very well in one plane, e.g. conducting well in two dimensions and has low conductivity in the third dimension. It can therefore be used both as a heat conductor and a heat shield at the same time. More about this new technology can be found at http://www.graftechaet.com/.

The best way to deal with heat in electronics is to limit the heat generated. That is to increase the efficiency. This is an ongoing process and progress is made all the time, but technical as well as financial restrictions will for sure prevent us from ever reaching zero losses. While dreaming about 100% efficiency making cooling unnecessary, we better learn everything we can about it. The life of our products depend on it

The constantly improving tele- and datacommunications have opened up for a distributed approach to design and development, in electronics as well as in many other industries. At the same time the European Union and other free-trade initiatives have made it easier to serve multiple countries from each logistics hub. Powerbox in Benelux utilizes this to give local customers strong support while maintaining a very lean local organization.

Lean and powerful

Global resources make a small local organization strong

The Benelux countries (The Netherlands, Belgium, and Luxemburg) are with a population of some 27 million a rather sizable part of Europe. All three countries were among the 6 founding members of the European Unit, which then was named the European Economic Community, in March of 1957. With the functions located here, most known are probably those in Brussels, the area plays a central role in the new Europe. Also from an industrial point of view the Benelux countries are important. Several large global companies are headquartered here. Most known are probably those in the medical, home electronics, and oil industries. These industries, and others, form a substantial market for power supplies. Powerbox opened its first Benelux office more than 20 years ago, and the development for our Benelux business is very encouraging.

Global muscles

Powerbox Benelux started as a collaboration between two companies. Karl Fredmark, founder of Powerbox, had a former colleague who ran a power supply business in The Netherlands. They discussed opportunities for cooperation and ended up starting a new company together in 1990. It was initially co-owned, but in January of 1999 it became fully owned by Powerbox. The main business was from the start a mix of custom and standard power supplies, with the former heavily relying on in-country design resources.

When Powerbox took full ownership the main focus initially turned to standard power supplies. Antoine Romme, head of Powerbox Benelux, started with the company in the spring of 1999. He remembers; “During my first years the business was dominated by standard units. We had a wish to expand in custom, but to be successful there would require considerably more design resources then what our business at the time could support”. Since then a lot has changed. Both the total business and the custom share have increased dramatically. The turnover is up by a factor of five and the custom share

has passed one third of the total sales, and continues to grow.

The road to success has not been local design resources. It has been efficient utilization of Powerbox' international resources. Several design teams, both within and outside of Europe, carry out original design and adaptations. Manufacturing resources in Europe and Asia take care of production. An international logistics network with carefully selected hubs makes sure the product arrives where and when it is required by the customer. On top of this, further streamlining the local organization, external local partners are used for many administrative and financial services. “The sum of all this”, Antoine says, “is that although we are only three people locally our customers have immediate access to the resources of a much larger company. The three of us are only the tip of an iceberg in the best possible sense. I do not represent a company of three. I represent a global company with vast resources. My colleagues are located all over the world”. He continues, “What the customers want is somebody local to have constant contact with, opportunity to meet face-to-face with our designers while a design project is running, and substantial resources to support them if any special need should arise. With our present set-up we are able to meet all this in a way much appreciated by our customers”.

Finding the optimal solution

When asked what he considers to be Powerbox' main competitive advantage he first says “it is probably different things for different customers”. Then he continues; “What I have found to be a major strength is our ability to cover everything from standard, via modified standard and value add, to full custom. Our aim is never to sell a standard unit, or a custom project. It is to sell a solution which can be either or, or something in-between”. “When a customer is starting a design project they often do not know if they can use standard power supplies or if they will require custom. If working with power vendors having their main offering in one or the other of these categories, the customer need to find out what they require before contacting the vendor, or stand the risk of being lead to something which is not optimal. As we cover the whole range the customer can safely involve us early in the project and use us as a resource in determining what they really need. The main point is not whether it is standard or custom. The main point is the combination of performance, lead-time, and price. We can act as an extension of the customer's purchasing department, assisting in their decision on which type of power supply to chose”. On the same topic Antoine continues; “It happens sometimes when we start what everybody believes to be a custom project, we find we can use a standard, or modified standard unit. Then everybody wins. The customer wins shortened design lead-time and lower price, and we free design resources we can use on other projects”.

Applications leading the way

Powerbox' Benelux business is targeting multiple industries, and has to date been most successful with Medical and Industrial applications. “We make substantial business in the Medical field with a very large company, making them one of our larger Benelux customers” says Antoine. “But the business is spread out over several industries and a large number of customers”. Entertainment and Security are other examples of industries present in Benelux where Powerbox has proven successful, both here and on other markets.

When describing his market Antoine sometimes says “Benelux”, and sometimes names a country. When asked about this he explains. “Although the Benelux countries in some aspects are closer tied together than many other countries are to their neighbours, they are very clearly three countries. There are differences in many areas such as culture, language and for part of the region also religion. In most cases we say Benelux when we talk about our office and the area we cover, but name the country when we refer to a specific place or customer”.

Thinking about expansion

Powerbox Benelux office is located in Breda, close to the Holland-Belgium border. Antoine refers to the location as “the middle of everything”. He explains; “We are halfway between Amsterdam and Brussels with about 100 km to either one, and have about 60 km to Rotterdam, Antwerp and Eindhoven. As so much of our time is spent visiting with our customers this central location is very convenient”. Bringing in design engineers is also very easy due to the close proximity to large international airports, and the constantly growing high speed train network.

When asked about the future Antoine first talks about business. “Although business both with custom and with our own standard designs have developed very nicely it would be nice to get an even higher percentage of the business with our own designs. But we will see. This is really determined by what is best for the customer. We do not set out to sell custom, or to sell a specific standard power supply. We set out to sell solutions”. Another area which appears to be dear to Antoine is services. “In recent years services have become an important part of our business. Examples are logistic concepts, forecast handling, project management, application engineering, well defined stock policy, reducing suppliers and free sample policy. Services is a way of doing more for the customer, which is always nice”.

Talking about the office and its staff Antoine returns to how well the utilization of design centres and logistics hubs located in other countries has worked out, but he also hints at the possibility of adding some technical capability. “We have probably reached the point where our next step is increased local technical ability. It would make us even faster in responding to customer requests for technical meetings, and who knows, if business keeps expanding we might sometime in the future become one of Powerbox' design centres”.

Did you know…

…in 2007 it will take only 3h13m to travel from Paris to Amsterdam and 1h46m to travel from Brussels to Amsterdam by train.

…Amsterdam is inhabited by 173 nationalities, has 600 000 bicycles, 200 000 trees, 1 281 bridges, 600 000 bulb flowers in parks and public gardens, but only one flower market.

…although known for being flat the Benelux countries are not all flat. The highest points in Holland, Belgium and Luxemburg respectively are 321, 694 and 559 meters above sea level.

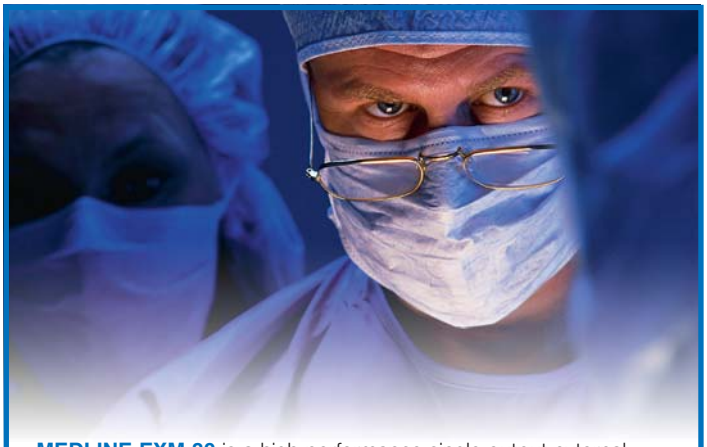
…Zénobe Gramme (1826-1901) and Leo Baekeland (1863-1944), both from Belgium, have made considerable impact on our industry with the development of the first dynamo and the first synthetic plastic (Bakelite) respectively.

> Although we are only three people locally our customers have immediate access to the resources of a much larger company.

MEDLINE

Un-matched power in medically approved open frame and wall plug external adaptors

The Powerbox Medline product portfolio is a family of medical externals 70 to 80 watts, open frame and enclosed 80 to 650 Watts all fulfilling the safety standard for medical applications. The introduction of the medical line of products supports the commitment to deliver innovative products that address the needs of the market.



MEDLINE EXM 80 is a high performance single output external AC/DC power supply providing 80 Watts output power in an attractive wall mount format. The industrial designer Ulf Hanses is responsible for the exterior design of Medline EXM 80. Ulf Hanses is well known for genuinely humorous, yet restrained designs during the last 25 years.

Electrically Medline EXM 80 features the latest fly-back topology and it is ready for world wide AC inputs. The leakage current is kept to a minimum allowing the power supplies in the Medline EXM 80 Series to be used in various medical applications. Medline EXM 80 Series also features exchangeable AC plugs for use in Europe, US, UK and Australia.

Features

- Highest output power on the market of wall plug adaptors
- Exchangeable AC-plugs for universal use
- Reliable front edge fly-back design with very low component count
- Very low leakage current
- Single outputs 12, 15, 18, 24 or 48VDC
- Class II double isolation and IEC60601-1 medical approval
- Made by Ulf Hanses, a world famous industrial designer

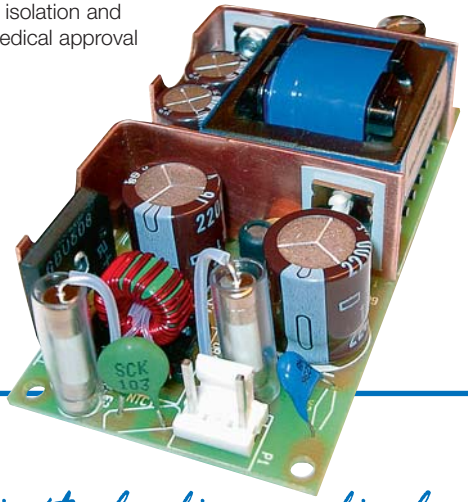
Exterior design by Ulf Hanses. Read more on page 14!

MEDLINE OFM 100 is a high performance and high density single output AC/DC power supply series in open frame format. It provides up to 100 Watts continuous in standardized PCB size 51 x 102 mm and 32 mm in height.

Medline OFM 100 Series features the latest fly-back topology and it is ready for world wide AC inputs, 100 to 240 VAC.

Features

- Ultra high power density 12.5W/sq inch
- Reliable front edge fly-back design with very low component count
- Standard 2x4 inch footprint
- Very low leakage current allow parallel connection for higher output power requirements
- Single output 12, 15, 18, 24 or 48VDC
- Class II double isolation and IEC60601-1 medical approval



Powerbox is the leading medical power supply manufacturer!

AUTOMOTIVE LINE

DC/DC converters for harsch environments

The Powerbox Automotive product portfolio starts as a series of six DC/DC converters for powering industrial computer systems at mobile vehicles as fork lifts and forest machines.

Powerbox has been successful in designing custom tailored products for automotive applications and the introduction of Powerbox Automotive Line means that we now also can offer our customers a wide range of standard products. Automotive Line provides encapsulated and potted DC/DC converter in ruggedized design with integrated mounting brackets. Built-in low input voltage protection also enables usage of long supply cables with significant conductor resistance.

- Input voltage range:
  9-36 VDC, 18-72 VDC or 50-150 VDC
- Output voltage/current:
  Single 13,2VDC/5.58A or 24VDC/3.1A
- Output power: 75W continuous

INDUSTRIAL LINE

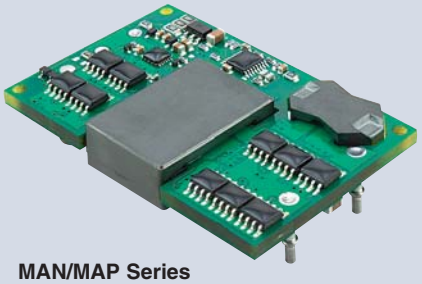
DRI100 – 100W DIN-Rail for demanding applications

Powerbox Industrial line of DIN rail power supplies starts with a 24 Volt, 100 Watts power supply. It's designed for demanding applications and offers excellent reliability and extra ordinary long lifetime. The guidelines for the designs has been to create a power supply to power important processes in production industry. A ruggid and lockable DIN rail clip ensures tight connection to a standard 35 mm DIN rail mounting bracket. The design also features the opportunity to connect up to 4 power supplies in parallell without external components.

High efficiency DC/DC modules

PHB75W Series

- 75W output power
- Efficiency to 85%
- 300KHz switching frequency
- 2:1 or 4:1 input range
- Regulated outputs
- Continuous short circuit protection
- Five-sided metal case
- Industry standard half-brick package
- Dimension 58 x 61 x 12.7 mm



MAN/MAP Series

- 180-300W output power
- Efficiency to 95%
- Input voltage 36-75 or 42-53VDC
- Output voltage 12VDC
- Fixed switching frequency
- Input under-voltage protection
- Over temperature/over current protection
- Remote on/off
- Industry standard quarter-brick package
- Fully isolated 2250VDC
- Output for intermediate bus architectures with POL converters

Supporting what we sell is part of the package

In a perfect world power supplies would never fail. In the real world, however much attention is spent on quality and operational conditions, they occasionally do. Powerbox' four Customer Service Centres are there to support our customers in case they experience this unfortunate truth.

> It is not until something fails and has to be fixed the customer will know whether or not they have chosen the right vendor

Stefan Altåker, Head of the Sweden Service Center

Repairs, spare parts and application support have been a part of Powerbox since the very beginning. Starting in 1996 it has been in the form of a dedicated separate service organization. Service Centres in Sweden, China, Australia and the USA support customers in their respective geographic regions.

Not growing, and proud of it

We meet with Stefan Altåker, head of the Sweden Service Centre, to talk about his centre and services in general. Our first question is about growth and success. How is Services doing? Is it an expanding part of Powerbox' business? Stefan gives us a strange look and explains: “Our repair operation is a service to our customers, not a business in itself. Although we do occasionally repair units from our competitors if one of our customers asks for help, the focus is entirely on supporting what we have sold. With the low and certainly not increasing failure rate of Powerbox power supplies the repair portion of the total business is stable, or even shrinking”. There are, however, other types of services which are expanding. Examples of this are logistics and spare part management, but that is another story which we will not go into here.

Technical support

The main activities at the service centres are claims handling, repairs and technical support. The latter is a form of help-desk primarily intended for the sales channels, assisting them in supporting the customers. Thinking about claims handling, the first thing that comes to mind is probably repairing or replacing faulty units, but there is more to it than that. “We keep track of all types of failure we find in all our different units”, says Stefan. “This way we sometimes find ways to improve a unit, or discover a weakness in a certain batch of a component. Then we can track where units with components from the same batch are and plan corrective actions”.

Stefan tells us that although most of the service centres' work is carried out at their own facility, they do sometimes venture into the field. “If we experience a higher than normal failure rate for a unit in a particular application, and do not find any explanation in the units themselves, we need to look elsewhere. We then work together with the customer, investigating the application and the environment the unit operates in. In many cases we then find something in the application, as for example temperature, input voltage characteristics, or maybe EMC radiation, which is outside of what the unit is specified and designed to withstand”. “This is a service appreciated by the customers, even when we find the problem is on their side”, Stefan says, “because we do find the problem and then it is in most cases relatively easy to fix”.

Good as new

When a power supply needs to be repaired it is of course convenient for the customer to have Powerbox' Service Centres close at hand. But the advantages do not stop there. “As we have all the information on specifications, test parameters, etc, which were used when the unit was first manufactured the repair we perform is not simply making it work again”, Stefan tells us. “The units leaving our repair shops meet the same specification as a unit fresh off the manufacturing line. For a simple power supply delivering an output voltage and nothing else this might not be a big deal, but with the increasing use of data communication and other advanced functions it is very important the repair includes bringing all parameters up to spec”. “It's like with cars”, says Stefan. “Many people can work on cars from the times of carburettors and mechanical systems, but with the modern computer-loaded cars you better go to somebody having both the knowledge and the equipment required for your particular model”. “Another advantage for the customer”, Stefan adds, “is that we implement new updates if availabe”.

Final test of confidence

During our talk with Stefan he states; “It is not until something fails and has to be fixed the customer will know whether or not they have chosen the right vendor”. This might by some be considered as a biased view, coming from someone running a service centre. As an alternative view we have also heard people say; “If nothing fails I know I made the right choice”. But in all fairness, going back to the difference between an ideal world and the real one, if you have a large number of units in operation you will experience failures. As much as we dislike thinking in terms of Powerbox power supplies failing, we are prepared for the occurrence. That is where Stefan and his colleges have an important mission. Showing the customers they made the right choice.

Shape

An unexplored aspect of power supplies

Streamliner

Other than fitting into a given space or standard building practice few thoughts have been spent on the looks of a power supply. But why is that, in a world where just about everything else is designed? Acclaimed industrial designer Ulf Hanses helps Powerbox break new ground.

The looks of a power supply does not make it any better from an electrical performance point of view. But what about how it makes us feel? Our homes, offices, and other public environments are full of them. Almost without exception they are black and relatively square in shape, as they protrude from our socket outlets and lie on our floors. And they do this in an environment where just about everything else present is designed to make it look nice. Isn't it time for power supplies to try and blend in a little better? At Powerbox we think it is. To explore this we work together with well reputed industrial designer Ulf Hanses.

Ulf Hanses is a playful functionalist with breadth and character. The genuinely humorous, yet restrained design is the charcteristic feature of his production as an industrial designer. From toy cars and planes to the internationally recognised and prize winning thermos from Boda Nova.

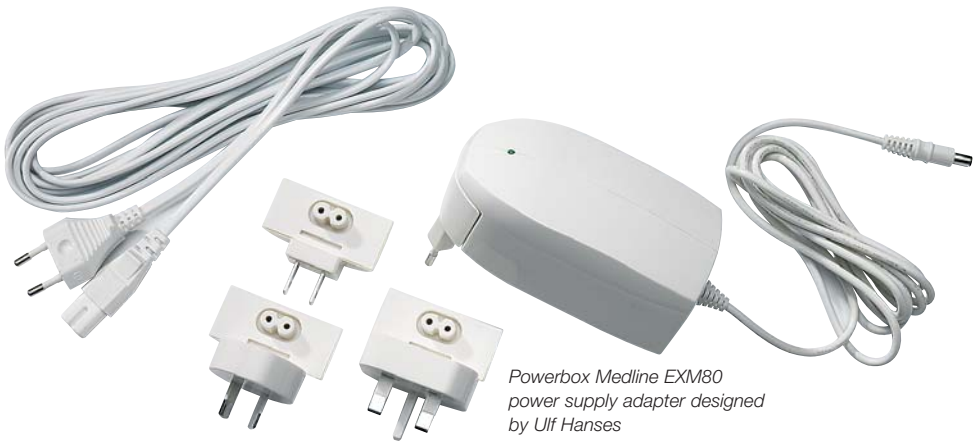
Creating desire to use

Ulf Hanses is a rare mix of technical fascination and artistic talent. Born and raised in a bakery and coffe shop environment his interest was very early channelled in two directions, both very much alive in him today. One was the technical interest, where he after having cleared all shops in his home region of any Meccano construction kit he could find evolved to among other things radio controlled model planes. The other interest was the artistic track with drawing and painting. This also later became his profession. After art school and the school of industrial arts he in the late 1960's started to work with famous Swedish designer Sigvard Bernadotte. A few years later he left the big firm and opened his own studio, which he still runs today. His work has been exhibited in numerous countries, from Canada to Japan, and he has won several awards.

When we meet him he explains his view on design, illustrated by two of his more famous projects; A Boda Nova thermos and the Streamline toy car. He says he is striving for a restricted, even simple design, giving the object its own personal soul. “If the design makes us want to use the object, and continue using it over a long time, it is really working” he says. He describes his working method as hands on, and trial and error. “Computers and 3D design programs are great for many things, but when developing a shape nothing can match working with things you can touch and hold. That is when you really feel what is good and what is not”.

First application for Medical

Ulf's first project with Powerbox is a power supply which plugs directly into socket outlets, intended for Medical applications. The design includes interchangeable adaptors for different outlet standards, allowing the same unit to be used globally. When asked how designing a power supply can attract a top notch industrial designer Ulf says; “This is in a way the last frontier. These units will be used in places like laboratories and hospitals. There the outlets are often high up on the walls. The units will be very visible, and they are today just about the only thing there which is not designed. To give them a shape nicely blending into the environment, at the same time as it is practical from a manufacturing and packaging point of view, is a very intriguing challenge”.



Powerbox Medline EXM80 power supply adapter designed by Ulf Hanses

The RoHS directive today and tomorrow

On 1 July 2006 EU directive 2002/95/EG came into force. Its full name is "the restriction of the use of certain hazardous substances in electrical and electronic equipment". This directive, and similar legislation in other parts of the world, are intended to speed up the elimination of some hazardous substances from electronics products and manufacturing.

The EU Directive bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. It applies to products sold new. Spare parts for products sold before July 1 2006 are not covered by the directive.

Evolving over time

Both the directive and its application will evolve over time. A Technical Adaptation Committee (TAC) with representatives from the EU membership countries have the task to keep the directive up to date. This involves both making good use of new technical development to further limit the use of hazardous materials, and to decide on exemptions for products and components where satisfactory alternatives meeting the directive are still lacking. Up to and including October 2006 as many as 29 exemptions were approved.

The development in the RoHS area is fast, and in 2006 alone the availability of RoHS compliant components increased substantially. It is very likely also products not covered by the directive will soon be compliant on component level. If the manufacturers then chose to use a compliant soldering process, these products will be in full compliance. It is the intention of EU to broaden the application of the directive into areas not initially covered. Recently the consultancy firm ERA Technology investigated for the commission the possibility of including product categories 8 (medical devices) and 9 (monitoring and controll instruments). Their finding, with some exceptions, is that categories 8 and 9 can be included starting year 2012.

RoHS in China

China introduces new regulations 1 March 2007. Although there is still an element of uncertaincy, the following is our interpreteation. The regulations apply to "Electronic Information Products", defined as; electronic radar products, electronic communication products, broadcast television products, computer products, household electronic products, electronic measurement instrument products, electronic products for professional use, electronic component products, electronic application products, electronic material product, etc. Some products within these categories, to be indicated in a list not yet published, are to fulfil all the hazardeous substance content criteria in full. For all other products within the categories only the marking described below as per fig. 2 will be required.

The substances covered are the same as in EU, with the addition of "other toxic or hazard substances set by the State". Step one will be marking of products where products fulfilling the requirements are to be marked according to fig 1. All other products are to be marked according to fig 2, where the number in the centre is to indicate the environment friendly use period of the product. This time period is to be determined by the manufacturer. In addition the manual accompanying the product shall include a table showing which substances are exceeding the regulated values, see fig 3, where "O" indicates compliance and "X" non-compliance. Also the packaging is to be marked with a special marking.

Certification is to be administered by the National Certification and Accreditation Administration. Third party certification is required, eliminating the possibility for self certification. A complication at present for non-Chinese companies is the lack of an officially approved translation of the Chinese directive, but there are of course unauthorized versions available.

Here to stay

There is no doubt RoHS and similar directives are here to stay. As new technologies and alternative materials become available hazardous substances will be faced out. Hopefully the requirements will be similar in different parts of the world. For electronics designers and users alike this is an important area to keep up to date with. It will impact not only the products themselves but also several aspects of handling, as for instance disposal at end of life. It is also an important part of taking care of our planet, an ambition we all need to support.

Fig 1

Fig 2

Fig 3

Part	Toxic and hazardous substances					
	Pb	Hg	Cd	Cr6+	PBB	PBDE
Xx	X	O	O	O	O	O
Yy	X	O	O	X	O	O

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