

BPO, we know how



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BPO

How to get from ideas and concepts to realised plastic parts? How to save on material costs? How to combine plastic with metal intelligently and skilfully? How to shorten the time to market for innovative products?

Experience shows that the answers to these questions are brought much closer by working with BPO (Delft, the Netherlands). The BPO team consists of both designers and specialised engineers. Together they develop and optimise products, aided by advanced computer analysing techniques. BPO supports and executes the complete product development process: from first sketch to production. BPO: twenty-five years of experience and know-how in product development and engineering.

Development

You have a great idea, but little or no experience in the development of plastic products. You lack the capacity in your own company or you just want an optimised product...

BPO is more than willing to be involved in the development starting with your first sketch. This stage already calls for several important questions to be answered. Can the product function with fewer parts? Which materials and which production methods are suitable? How strong or stiff should the product be? Is it safe and what is its life expectancy? How much does the product cost and can it be produced more cheaply? How can a better air, gas or fluid flow improve the performance of your product?

Like no other, BPO is capable of predicting at an early stage the consequences of certain design choices for the final product. This insight saves a lot of time and prevents expensive changes late in the development cycle. BPO arranges brainstorm sessions to generate ideas for you. Insight in the appearance of your product is given with 3D visualisation. The economic and technical feasibility is assured by comprehensive studies. BPO initiates and supports innovation.











One objective: your product

BPO is of service in a wide range of projects: from short optimisation or detailing projects to long term major development projects. The distinguishing mark in all our work is our direct and hands-on approach. This is appreciated by companies of all sizes.

In the end the most important aspect is always the cooperation between people that speak the same language. With one common objective: an optimal end result. BPO communicates intensively. Not only in person but also by using the internet, so that wherever you are located, BPO keeps you up to speed on the latest developments in the project and on the status of your product designs.

People

Since being founded in 1987, BPO has combined the skills of engineers specialized in all different aspects of product development, including design, construction and manufacturing. A growing number of clients profits from the multi-disciplined approach of BPO. The team is continually expanding and currently has the responsibility for projects all over Europe and indeed around the world.

Resources

BPO has a number of advanced tools at its disposal, to be able to perform our professional services effectively. The tools are used to develop complex products and to answer difficult questions. BPO's engineers use multiple 3D CAD programs, like SolidWorks and Creo. Analyses are conducted using advanced FEM software, capable of performing non-linear static and dynamic mechanical analyses, fluid dynamics analyses and optimisations. With Optistruct the optimal geometry based on combined loads on a product can be calculated. We have a state of the art 3D printer that can be used during development as well as a 3D scanner to create legacy data and to compare First of Tools with the 3D CAD files on which they are based. We will keep investing in future opportunities in product development to be able to give our clients the best and most complete service: creating value!















01 idea 02 concept 03 materialisation















04 optimisation



















Optimal sound experience

D&M Premium Sound Systems has an unparalleled reputation as a worldwide developer of audio systems. Among its customers are BMW, Ford, General Motors, PSA Peugeot Citroën, Toyota and Volkswagen. BPO has assisted D&M PSS with the development of the speaker boxes in which these audio systems function. An example can be found in the design of a subwoofer box for the Citroën C5.

During the development of a new car a lot of time and energy is used to prevent unwanted noise and vibrations from getting into the car's interior. Within the interior also a lot of attention is given to vibrations. It is unwanted that a part is rattling during a drive. This is especially important for speaker and subwoofer boxes. The vibration behaviour of these kinds of speaker housings and the interaction with their environment therefore has top priority.

The random vibrations that occur during driving can be described with a frequency spectrum. BPO has calculated the maximum displacement of the subwoofer box using a norm-based spectrum. To be able to do that, all natural frequencies and their vibration modes up to 300 Hertz were simulated.

Out of the simulations a couple of areas of concern were distilled, for instance the connection between the two main parts of the box. Also the connections of the subwoofer, the CD changer and the box as a whole required reinforcement. The vibration behaviour has been improved significantly by adding wall thickness and ribs on very specific spots. Next to that, BPO advised on the material choice. In combination with high end audio systems the speaker housing contributes to an optimal sound experience inside the car.









Cable Carrier

DAF Trucks has introduced the MX 12.9 liter engine. The cable carrier for this engine, guiding the cables to the electronic fuel injectors and also the guidance of the DAF Engine Break, has been developed by BPO in close cooperation with the manufacturer voestalpine Polynorm Groep.

The development of the cable carrier is a good example of state-of-the-art engineering. The limited space and special application demand a very complex geometry. Multiple film hinges are used to keep the assembly as simple as possible. It was necessary to use separate parts in some areas because of mutual tolerances and limited space. Because of this supports that can be assembled separately have been constructed around the camshaft and valve rods. The carrier is placed close to the cylinder heads where oil with a temperature of 120°C is continuously flowing through. Because of this a heat resistant glass fibre reinforced PA6 plastic has been chosen.

Simulations of the behaviour of the carrier under loading were carried out more than once during development. The cable carrier has been analysed and optimised for a number of different load cases. Special attention was given to the vibration behaviour at different temperatures. To determine the best possible injection positions and to prevent problems at the film hinges extensive moldflow analyses have been conducted. In the end the product not only provides more than adequate protection of the electronic cables during millions of kilometres but it also serves an important role during assembly and maintenance of different engine parts.

II. Multiple film hinges are used to kee Od the assembly as simple as possible.



Bread crate

BPO has developed a bread crate for LINPAC Materials Handling from Bad Salzuflen (Germany). In this project all aspects of the product development process have been addressed.

Using the functional requirements as put forward by the client, BPO generated different ideas in sketches and 3D CAD models. Next to that, the compatibility of the new crate with existing competing products already on the market had to be guaranteed: the mutual stackability and the dimensions had to be tuned to achieve this. A spear point during the development process was to construct the crate for a short as possible cycle time, because the crate was to be produced by injection moulding. Certain difficulties that normally characterise injection moulding, like warping because of uneven shrinking, have been overcome by subtle wall thickness differences and by using double curved surfaces in the geometry. During this development the mould construction was always in the back of our heads.

The crate has to fulfill the strictest requirements concerning deflections and stacking loads for its particular application. A starting point for this development was: minimising the material usage and the production costs. By implementing a, for this market segment unique, corner column construction as is normally used in beer crates, the crate performs equally as well as much heavier crates in its segment.

The Panetto bread crate has a 5% larger inner volume compared to its predecessor, at the same time the material usage has been reduced by more than 20%! The ergonomic and comfortable grips are another important innovation. The construction of the bottom provides the necessary stability while maintaining a distinct aesthetic appearance. All four sides of the crate have surfaces fit for printing, In Mould Labelling (IML) can also be used there.

The development of the Panetto is an example of a project where all skills present at BPO were used: form and function were integrated into the design of the bread crate, using strength and stiffness analyses together with mould flow analyses and CAD modelling.

Fig. 01



Pallets, trays and crates

BPO has developed and optimised scores of products for application in logistic chains over the last 25 years. Plastic pallets, trays for bottles, plants and storage systems, crates and boxes for vegetables and fruits, car parts and technical products.

Next to strength, stiffness, stability and design, the costs of these products is of the utmost importance. The products are manufactured in very large series with very expensive tooling. To be able to develop optimal products BPO employs advanced engineering and optimisation tools. For instance, a number of boxes and pallets have been developed using Optistruct. This software calculates the optimum geometry for multiple load cases during the concept stage of development. The results of these analyses give intelligent input for the further development, where functionality, details, design and producibility are integrated into a new product.

Using these modern and advanced design tools we have been able to realise mass reduction of up to 30% and cycle time reductions of up to 45%, where the product is still robust and fit for its application.





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Ahrend 380

The Ahrend 380 is a timeless contemporary design of a chair made completely of recyclable plastic; the result of a collaboration between designer Ineke Hans and Ahrend. The Ahrend 380 is light, stackable and comfortable. The main starting points for the design: a small number of parts, a relatively simple production process and recyclable materials.

The chair consists of a backrest and a seat with legs. The backrest is made of Xenoy with added recycled PET. Using the wooden models and extensive design sketches of Ineke Hans, BPO engineered the chair to a ready for production design. The different parts were built up in 3D CAD, while already considering the required production technique of injection moulding in the early stages of the development.

With extensive analyses the chair was then optimised to fulfill the strict norms and requirements that Ahrend applies to its products. The backrest has been optimised using FEM analyses to have sufficient strength, while maintaining enough flexibility especially in the top part to feel comfortable to sit on.

Designer Ineke Hans and Ahrend together have been awarded the Design Factory Prize. The Ahrend 380 chair was found to be the most successful collaboration between designer and industry for its material use, particular design, sustainability and its good use of colour. It is a collaboration that has been facilitated by the engineering and optimisation of BPO.

GIO Design Award



ig. 02







Samsonite S'Cure

Samsonite is market leader in luggage and aspires to sell beautiful and innovative products worldwide. The S'Cure is the lightest polypropylene travel suitcase until now. This innovative suitcase has been developed in an intensive and long-term cooperation with BPO.

Because the suitcases of Samsonite are subjected to heavy loads in different tests and because weight is of increasing importance for luggage, BPO supported the project from the start with highly advanced FEM analyses. Deformation, maximum stress and the weight of the product were constantly observed for different, mostly dynamic, loading situations. Advice has been given to improve the design and to help making choices. To be able to create a stiff and stable rim a large number of techniques and geometric shapes were evaluated during the concept phase. Also, a topology optimisation was used to generate and analyse different variations on a pattern of grooves on the surface of the shells.

To find an optimal combination between performance and weight both shells have also been optimised using moldflow calculations. Using these analyses the wall thickness distribution has been chosen to design a suitcase that can be produced within the available clamp force, while maintaining the balance between performance and weight. The largest (75 cm) version of the new S'Cure weighs only 4.5 kilograms, the smaller (69 cm) version weighs even less at 4.0 kilograms, over 20% lighter than their predecessors.







Solar panels on flat roofs

The many flat roofs of office and commercial buildings offer tremendous potential for the installation of solar panels. For easy installation of the panels, German company SOLON introduced the SOLfixx system. BPO contributed to the development of the system with strength and stiffness analyses, moldflow analyses and the design of the wind deflector.

The SOLfixx system consists of a plastic console which can be anchored to the roof in different ways. The console is an injection moulded plastic part of 1.45 m by 2.12 m that is made in one shot. Production is done at injection moulder HSV with a 17 gate hotrunner with cascade injection that has been optimised by BPO. The location of the various injection points and when each of these has to be opened was determined. The wall thickness and flowleaders are optimised to minimise product weight at a maximum allowable clamping force of 4000 ton.

To decrease the effect of the wind loads BPO developed a special wind deflector that clicks into the console. It consists of a series of lamellae which keep the wind from getting any grip on the solar panels. The shape of the lamellae makes the wind deflector flexible. This keeps it attached to the console even if it deforms due to high winds.

The mechanical behaviour of the SOLfixx system at extreme wind and snow loads is also optimised by BPO. Because the system has to remain on the roof for over many years, the creep loads, weather influences and UV radiation have all been taken into account.



Ti The simulation of the mechanical behaviour takes into account extre of wind loads, snow loads, creep and UV radiation.

THILL

BPO has used its experience of the development of plastic products that are subjected to extreme circumstan



SEMIO semi-underground waste system

ESE, Environmental Systems Expertise, has introduced a stationary waste and recycling container to the market. The SEMIO is a 5 m³ semi-underground waste system using a concrete body, which is fixed in the ground, and a mobile UV resistant polyethylene body, which can be hoisted by waste collecting trucks.

The SEMIO is perfect for all spaces with high amounts of waste. It offers a large fill volume, reduces emptying frequency and lowers maintenance costs. Only one third of the product is above street level. The SEMIO with its new straight design and all its various finish options can be integrated into many different public spaces.

BPO has assisted ESE in both development and engineering as well as optimisation of the SEMIO. The design is based on a straight shape and wide bottom opening to ensure smooth flow of waste from the container. The main construction is based on computer simulations (FEM) and a long list of requirements, which has led to a sustainable product. Individual components such as lids, various disposal openings, and three types of hoisting systems are inter-changeable. Not only does this result in specific features per customer, but also in easy maintenance which means that the products are long-lasting.

ESE always considers the entire logistic and application chain when designing products, including requirements for filling, emptying, handling, health and safety. SEMIO fulfills all current European and national standards and is certified in accordance with the European standards EN 13071.









Party? "TAPJE"!

Heineken has introduced "Tapje", a light and user-friendly home beer tapping packaging made of the plastic PET. It is not just some beer packaging, but a unique product with a presence of its own as an innovative image carrier for Heineken and Amstel. It can be carried comfortably, is easily made ready for use and especially suitable for special occasions, like a party or barbecue. Not only the brand image and ease of use were important starting points for the development, but also efficient assembly, the resistance to pressure of the keg and a minimal use of material were of great importance. This home tapping keg is 50% lighter than its steel predecessor.

The emphasis of the contribution of BPO was on the feasibility and technical development of the most challenging part of the product: the PET-keg. The keg must not only have a relatively large content volume, but also resist the high pressure the carbon dioxide in the beer can build up.

The shape of the keg has been optimised using FEM-analyses, to have as little deformation as possible, while using as little material as possible. A couple of variants have been made and tested in practice, until the final design best combined the strength and stiffness requirements with the required look of the product.

BPO has subsequently engineered the other parts of "Tapje" to reliable and easy to produce plastic parts. BPO also made all the part and assembly drawings for Heineken.











Packaging

Packaging is often characterised by being produced in large number and by being for one time use only. Also, the parts, often made of plastic, must comply with a whole range of requirements. This combination makes the development of good packaging a real challenge. In its 25 years of existence BPO has developed and optimised scores of packagings. Often material reductions of 10% have been achieved, cycle time reductions of several seconds and new techniques and materials have been introduced. We are always at the forefront of using the latest developments and innovations in our projects.

The results of these projects have been on the market for years now. From margarine tubs (of which yearly hundreds of millions are manufactured) to beer kegs, from aerosol caps to paint cans. A wide range of packaging designs, always as light possible, suited for its application but not a gram overweight.

Tubs are a good example of the simultaneous optimisation of strength and moldflow. Using finite element analyses first the strenght of the tub can be improved, while decreasing the amount of plastic needed per part. Next extensive mould flow analyses can be performed, improving the flow in the mould. Flowleaders in the bottom can be used, so the tub can be produced with different IML thicknesses or without IML, while retaining its favourable flow characteristics.

The weight of tubs can be reduced with several percents, while the strength remains sufficient. A balanced flow guarantees fast and reliable production and IML placing.











company, 1 goal – your product

colleagues – from industrial designers to mechanical engineers

customers – worldwide, from small companies to Fortune 500

projects in 25 years - from small optimisations to complete series of products

tons material saved – that is 50.000.000 kg

hours cycle time saved - that is more than 300 injection moulding machines

kg CO₂ saved...

A selection of BPO's customers, which total to over 300:

Heineken / Unilever / ESE / Danone / Samsonite / RPC Bramlage / Villeroy & Boch / Schoeller Allibert / Dyka / BE Aerospace / Plasticum / AAF / Hollarts Kunststoftechniek / Craemer / Gizeh Verpackungen / HSV / Ahrend / Steelcase / Flamco / Zehnder Group / Ehlebracht / Haidlmair / Denios / Promens / Hettich / RK Rose+Krieger / Handicare / Ikadan / ...





















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