Deadlines for drivelines

Prototype construction and surface coating as a race against time

The demands on modern automobiles are virtually impossible to achieve. They have to be dynamic and powerful, yet at the same time eco-friendly, economical, quiet and safe. The driveline plays a crucial role in meeting these performance requirements. No wonder, then, that – in the prototype stage – the tests for new drive shafts and joints are also extremely demanding. To ensure that in this phase the drive shafts deliver – not only technically but also in terms of their optics – on what they promise, Neapco Europe GmbH, an internationally operating developer and manufacturer of chassis components, has them coated by the German company Pallas GmbH & Co. KG. As a proven specialist for sophisticated surface engineering, Pallas has exactly what it takes to complete the coating jobs "just in time", in spite of the challenging technical specifications and the extreme time pressure.

Founded in 1924, today Neapco is an international technology leader with five global locations – in the USA, China, Mexico, Poland and Germany – and employs over 2,200 people. Neapco Europe GmbH is located in Düren, Germany. With a staff of 850 employees, it develops and produces drive shafts, differentials and wheel hubs for almost all of Europe's premium automobile manufacturers. Starting in summer 2018, this is where the StreetScooter will be manufactured for the Deutsche Post. At the same time, Neapco's prototype shop in its Düren works is the company-wide competence centre for the development of new components. This is the

command centre for Neapco's application engineers all over the world, and it is also here – in Düren in Germany's Rhineland – that all of the concern's prototypes are manufactured. Whether the drive trains are destined for internal combustion, hybrid or electric motors, for front or rear-wheel drives, for off-road SUVs or all-wheel drive models – Neapco creates drive shafts, joints and collars, all of them tailored perfectly to the particular drive technology and assembly scenario. Thanks to integration of construction, production, quality assurance and logistics across all its company locations, Neapco supports its customers from initial concept, development and testing right through to serial production.

Everything from a single source

Such service calls for state-of-the-art technologies and processes that guarantee precision-engineered solutions. So the prototype shop offers a comprehensive portfolio of drive shafts that, over the years, have been continuously further developed in collaboration with the various OEMs. Depending on the required power transmission, the Neapco engineers select the suitable shaft type from this portfolio. This could be anything from a hollow shaft for a standard passenger vehicle to the solid shaft required for reasons of stability in the case of a truck, or a tubular shaft, or a swaging shaft or a shaft in the form of a dog bone. Configuring the technically sophisticated components to the specific vehicle type involves an extensive prototype process in which crash behaviour, driving comfort, noise minimisation, weight, durability, power transmission, accuracy of fit, frictional resistance, stability, turning circle and corrosion resistance are all optimised so that the drive shaft efficiently fulfils all these requirements to the greatest possible degree. Only when the shaft has proved its perfect performance in subsequent laboratory and practical tests does it go into serial production.

Always scalable to demand

Whether it is a longitudinal, side or cardan drive shaft – the process always begins with a customised concept. On the basis of detailed customer specifications regarding shaft centre distance, material, form and type of connection, torque, weight and performance, Neapco's experts develop a design which they agree on with the customer's engineering team. One of the Düren-based company's basic principles is always to make the front shafts the same in order to avoid differences in vibration. In order to follow up on the pure idea by presenting their customer with an initial result as soon as possible, Neapco combines mechanical and virtual procedures in the development stage. Quick decision processes enable the specialists to prepare prototypes very rapidly and put them into serial production. For example, in its prototype shop, Neapco may mill components like bell or tulip housings from solid blanks for test assemblies or for pre-tests, or perhaps occasionally weld together shafts just to get a first impression. Even jobs like rotary swaging can be performed at short notice thanks to access to the in-house production line. It is because of this enormous flexibility and job-based scalability that Neapco, a relatively medium-sized company in German terms, can successfully hold its own against strong competitors. In multi-stage tests, the prototypes are then subjected to up to 2,500 test cycles which are conducted according to the detailed specifications of the customer. But the shafts are not only put through their paces in Neapco's own test facility. In addition, when close to serial production, their efficiency, functionality and durability are checked in real-world operation on the test ground and in road tests.

Surface coating at the drop of a hat

Anywhere from 50 to 200 prototypes are constructed for each shaft before it is ready to go into serial production, which at Neapco may involve the manufacturing of just a small batch or in large quantities depending on the particular intended use. On average, the company delivers up to 5,000 individual assemblies per year – complete systems consisting of drive shafts with joints and collars. Manufacturers of premium brands in particular expect the shafts to have corrosion-resistant coating, even in the prototype stage. But the special coating is also expected to give the components the high-value look of the later serial products. This is an elaborate and always extremely time-sensitive job, for which Neapco identified the surface engineering company Pallas as an eminently suitable partner. For many years now, the automotive supplier has been relying on the comprehensive procedural competence of the surface treatment experts at Pallas with regard to its tool-making needs. Whether these needs are for the coating of worn-out bearings with hard metal, or hard chromium plating as protection against wear or corrosion for shafts, or non-stick coating for filling machines – thanks to the wide range of equipment, working materials and procedures at its disposal, Pallas is always ready with the optimal solution for every task and is able to do the job practically at the drop of a hat. Depending on the specific procedure and working material, coating thicknesses from just 20 microns up to several millimetres can be achieved. Due to the lack of restrictions on base materials and a virtually unlimited choice of coating materials, thermal coating has a very versatile range of application. By combining several thermal spraying methods, in many cases Pallas actually improves the efficiency of the surface treatment even further. Cost-intensive components, time-sensitive functions or required enhancements of the properties of the components often make having such thermal coatings done by Pallas the only viable option. And these years of proven experience in the creation of customised thermal coatings are what made

Pallas the perfect choice to also handle the surface coating of the drive shaft prototypes for Neapco.

The first challenge related to the low-distortion application of the electrostatic powder coating. To preserve the dimensional accuracy of the hardened shaft, Pallas first had to find a powder that melts at a low temperature. Normally, powders are used that melt at temperatures of 180°C and higher. But, in the coating of the drive shafts, under no circumstances was a temperature of 160°C to be exceeded in order to stay below their annealing temperature. As a qualified expert for coating materials, Pallas helped the automotive supplier with the selection of a suitable plastic powder. A second challenge relates routinely to the extremely laborious manual masking before the coating process. Many a surface coater has already thrown in the towel due to the sheer number of inaccessible places and special masking requirements. Each component needs masking with a variety of special masking tapes – a very time-consuming task. In the case of shafts for electrically powered cars, the specific challenge is that, instead of the usual radial masking, covering of the upper surface has to be ensured. Thanks to its great experience and the range of materials at its disposal, Pallas can also meet exacting demands like these. After the degreasing and masking stages, Pallas blasts the shafts with white corundum. Then the plastic powder is applied electrostatically by pistol and melted in a furnace. In this stage, it really pays off that Pallas has several furnaces at its disposal and ready to use at practically a moment's notice.

Minimal reaction time

Neapco's long-standing customers know that the automotive supplier has a very broad portfolio and thus expect extremely fast delivery of the requested components. Because these components have not yet been

coated, Pallas has only a minimal timeframe in which to get the job done. Lead times of just two days are not uncommon. "There have been repeated cases in the past when Pallas received components from Neapco on a Friday afternoon for surface treatment over the weekend so that they could be delivered to Neapco's customers on the following Monday morning," recalls Dirk Möchel, long-standing department head of the Tool-Making and Prototype Shop sector at Neapco. For Pallas, this means having to be able – at shortest notice – to put together a team for weekend work and to make the required infrastructure available in order to meet the deadline for the complex treatment of the components. A task which the surface engineering experts always fulfil with flying colours – thanks to the range of procedures and equipment available to them in-house and to a very highly motivated team. Dirk Möchel certainly appreciates the service. "The collaboration with Pallas is unbeatable! We are extremely satisfied." And Michael Freitag, head of the Prototype Shop, adds: "Their openness in communication, their profound know-how and their enormous flexibility make Pallas a highly valuable partner for us."

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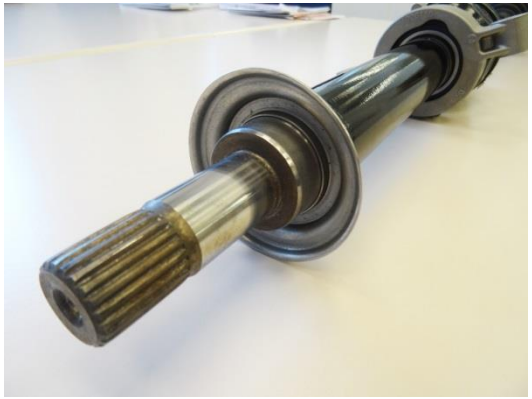
Pictures 1-3: To ensure that in this challenging prototype stage drive elements like link shaft, joints and swaging shafts deliver – not only technically but also in terms of their optics – on what they promise, Neapco Europe GmbH has them coated by the German company Pallas GmbH & Co. KG.



Pictures 4-5: The partial masking of those components before coating requires a lot of skill and experience at Pallas.

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Pictures 6-7: Whether drive shaft, connectors, joints or collars: Tailored by Neapco as prototypes with anti-corrosion coatings from Pallas.

Pictures 8-10: Neapco relies on the in-depth material and process know-how of Pallas GmbH & Co. KG to coat the outer joints and their spur gearing.

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