NATO OTAN

NCAGE Code: 9BT1H

OMNI3D

PRINT LARGE FUNCTIONAL PARTS

REPLACING METAL WITH HIGH-PERFORMANCE POLYMERS: A CASE STUDY

FROM METAL TO POLYMER: EXPANDING THE HORIZONS OF ADDITIVE MANUFACTURING

Additive Manufacturing (AM) has evolved into a reliable technology that seamlessly integrates with traditional manufacturing methods. One of the most transformative trends is the **replacement of metal parts with high-performance polymers**, offering advantages such as reduced weight, enhanced design flexibility, and improved production efficiency, particularly in aerospace, automotive, and railway applications.

Breaking Free from Legacy Constraints

AM's ability to produce complex geometries and on-demand parts is revolutionizing industries dealing with **legacy equipment** and **supply chain limitations**. Instead of grappling with broken or obsolete metal components, AM provides a rapid, viable alternative, significantly reducing downtime.

Weight Reduction: A Critical Advantage

In weight-sensitive industries like aerospace and transportation, polymer-based solutions deliver significant weight savings without compromising performance. These **lighter components** enhance fuel efficiency, increase payload capacity, and reduce environmental impact, positioning AM as a superior alternative to traditional metal parts.

The Importance of Industrial-Grade Equipment: A Deeper Dive

To maximize the potential of polymer-based 3D printing, investing in high-quality, industrial-grade equipment is essential. These advanced systems are designed to handle large-scale production, ensuring consistent quality, reliability, and efficiency.

Why Industrial-Grade Equipment Matters

- **Build Volume:** Industrial printers offer larger build volumes, enabling the production of sizable, complex parts.
- **Material Compatibility:** Capable of processing a range of high-performance polymers such as PEEK, PEI, and ULTEM, these printers produce parts with superior mechanical and thermal properties.
- **Precision and Accuracy:** Advanced control systems ensure precise, repeatable results, essential for parts with tight tolerances.
- **Reliability and Durability:** Built for continuous operation, industrial printers are designed for the rigors of industrial environments.
- **Open Material Systems:** Flexibility to experiment with a variety of filaments and materials allows for optimized part properties and innovative applications.

Omni3D: A Leader in Industrial AM

Omni3D leads the industry with advanced 3D printing solutions tailored to meet demanding industrial requirements. Our large-format printers, equipped with heated chambers, are optimized for processing high-performance polymers.

Why Omni3D's Heated Chambers Make a Difference

- **Precise Temperature Control:** Maintains optimal crystallization and minimizes warping throughout the print.
- **Uniform Heating:** Consistent temperature distribution prevents defects from hot or cold spots.
- **Closed-Loop Control:** Ensures stable temperature settings, even during long print jobs.
- **Compatibility with High-Performance Polymers:** Designed specifically for materials like PEEK, PEI, and ULTEM.

Automotive

OMNI3D

Maintenance | Replacement Part

FINAL PARTS PRODUCTION FOR RACING CARS

PRz RACING

OMNI TECH

APPLICATION
Intake manifold

MATERIAL
CF-PA-12

DIMENSIONS
291x290x226 mm

WEIGHT
570 g

PROBLEM

The PRz Racing Team needed to produce multiple critical components for their PMT-03 racing car, including an intake manifold, a gear mount, and a joint cover. These components had to meet specific requirements such as resistance to high temperatures, vibrations, and chemical exposure. Additionally, reducing the weight of these elements compared to traditionally manufactured parts was crucial for improving the car's performance. The team required solutions that allowed for flexibility in design iterations and provided fast, cost-effective production.

SOLUTION

OMNI3D's large-format 3D printing technology provided the ideal solution to the PRz Racing Team's challenges. Using the Factory 2.0 NET printer and materials such as CF PA-12 (carbon fiber reinforced polyamide) and TPU-93A, the team was able to produce lightweight, durable, and heat-resistant components. The intake manifold, for example, was printed with CF PA-12, providing the necessary strength and stiffness while **reducing the component's weight by 1.5 kg** compared to aluminum. The gear mount, another crucial part, was also printed using CF PA-12, resulting in a part 1 kg lighter than its traditional counterpart. The joint cover, printed with TPU-93A, offered flexibility, strength, and chemical resistance.

APPLICATION
Gear mount

DIMENSIONS
365x77x60 mm

MATERIAL
CF-PA-12 + ODS20

WEIGHT
206 g

APPLICATION
Joint covers

DIMENSIONS
75x60 mm

WEIGHT
33 g

MATERIAL
TPU-93A

Railway

OMNI3D

Maintenance | Replacement Part

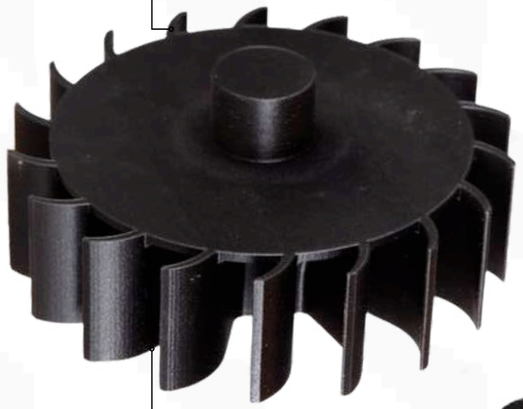
VACUUM PUMP ROTOR

LUK-PLAST s.c.

OMNI PRO

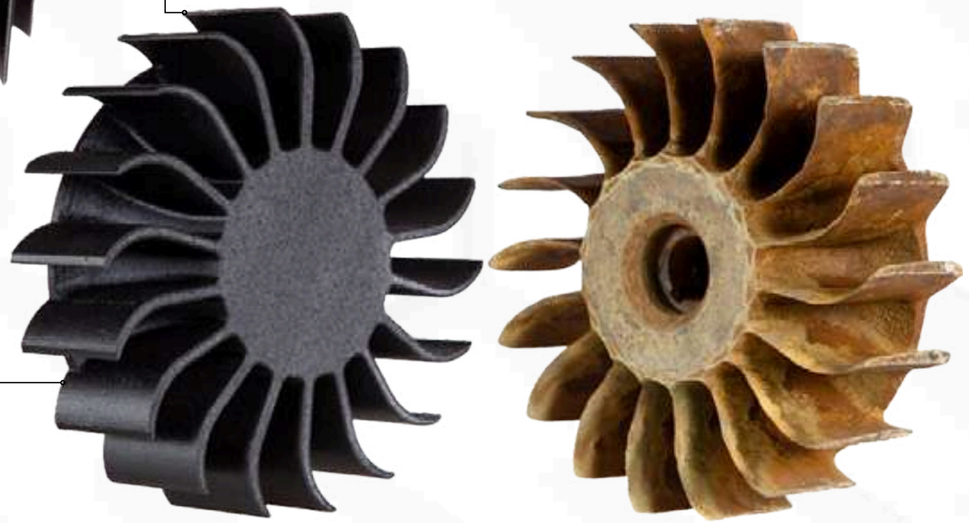
APPLICATION
Replacing the existing brass component

MATERIAL
CF PA-12



DIMENSIONS
210x90 mm

WEIGHT
872g



PROBLEM

Luk-Plast's brass vacuum pump rotors wore out rapidly due to harsh conditions, including exposure to high temperatures, aggressive chemicals, water, and gas. The high-speed operation of the pumps (up to 1400 rpm) and continuous duty added mechanical stress, leading to frequent replacements, increased downtime, and rising maintenance costs. This environment proved too demanding for traditional brass components, which could not withstand the operational requirements for long periods, causing inefficiencies in railway systems.

SOLUTION

OMNI3D addressed these challenges by designing a 3D-printed rotor mount using the Omni PRO printer. The printer's heated chamber (up to 140°C) was essential for producing durable parts from high-performance materials capable of enduring the extreme conditions. Precise temperature control ensured that the 3D-printed component retained its strength and stability, even in the face of aggressive chemicals and high mechanical stress. This solution significantly extended the rotor's lifespan, reduced maintenance intervals, and minimized both downtime and costs, while ensuring reliable performance at high operational speeds.

Defense/Aerospace

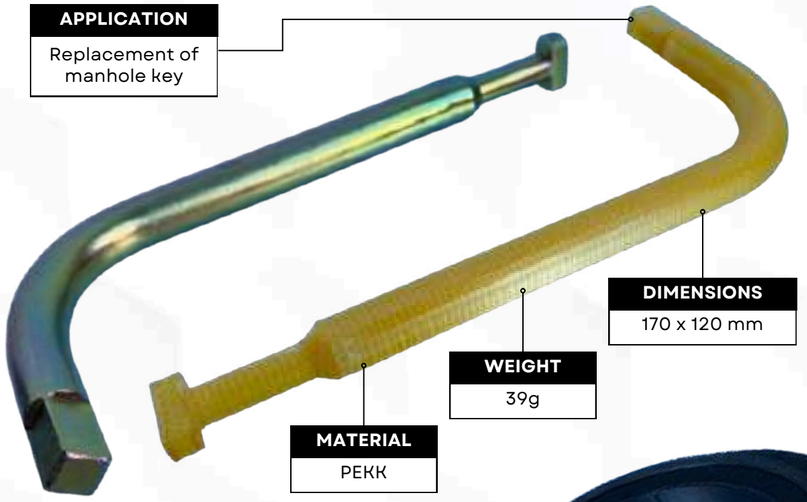
OMNI3D

Maintenance | Replacement Part

BMP-1 VEHICLE PARTS

SKF

OMNI PRO



PROBLEM

Maintaining a fleet of BMP-1 vehicles, which are key assets for many NATO military forces, presents significant logistical challenges, especially during wartime. Procuring replacement parts for these aging vehicles is both time-consuming and expensive, with long lead times that can jeopardize operational readiness. Relying on external suppliers exacerbates these issues, increasing downtime and making it difficult to keep these vehicles in service when they are most needed.

SOLUTION

OMNI3D's large-format 3D printing technology offered a game-changing solution. By using durable material extrusion techniques, NATO forces can produce high-strength, functional parts for BMP-1 tanks directly on-site. With a digital library of BMP-1 components and the ability to deploy Omni3D printers in the field, military forces can bypass traditional supply chain delays, print replacement parts on-demand, and ensure continuous vehicle operation with minimal downtime. This reduces reliance on external suppliers and significantly improves fleet maintenance efficiency.

Defense/Aerospace

OMNI3D

Low Volume Manufacturing

PRODUCTION OF HEXAPOD COMPONENTS

Symétrie

OMNI TECH

APPLICATION

Components for Precision Positioning and Motion Systems

MATERIAL

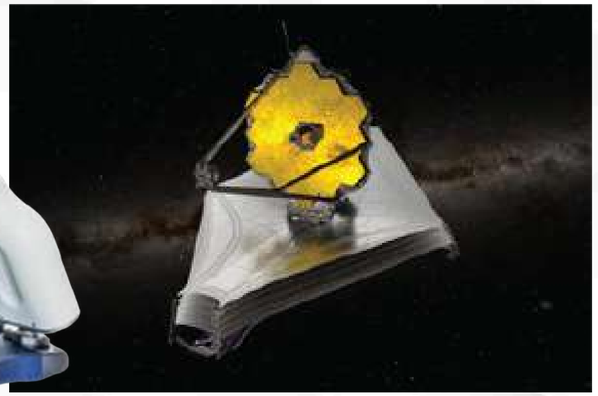
CF-PA12

PROBLEM

Symétrie, a leading manufacturer of aerospatial hexapods, was facing delays in its supply chain and increasing production demands, particularly during the global supply chain crisis of 2022 and the COVID-19 pandemic. Additionally, Symétrie needed a solution for manufacturing complex large-scale parts that were impossible to machine using traditional methods, while maintaining the required precision and quality standards.

SOLUTION

To address these challenges, Symétrie turned to 3D printing and invested in an Omni TECH 3D printer from OMNI3D. This technology allowed the company to internally produce large and complex 3D parts, such as cable trays, spacers, and PCB covers, which were essential for their hexapods. With the use of CF-PA12 filament, Symétrie was able to quickly create durable and precise components with the flexibility to make adjustments on the fly. This reduced their reliance on external suppliers and improved production efficiency by cutting lead times from weeks to mere hours. Additionally, 3D printing enabled the rapid prototyping and production of parts for design validation, ensuring faster iterations and reducing risks associated with breakage.



Manufacturing

OMNI3D

Maintenance | Replacement Part

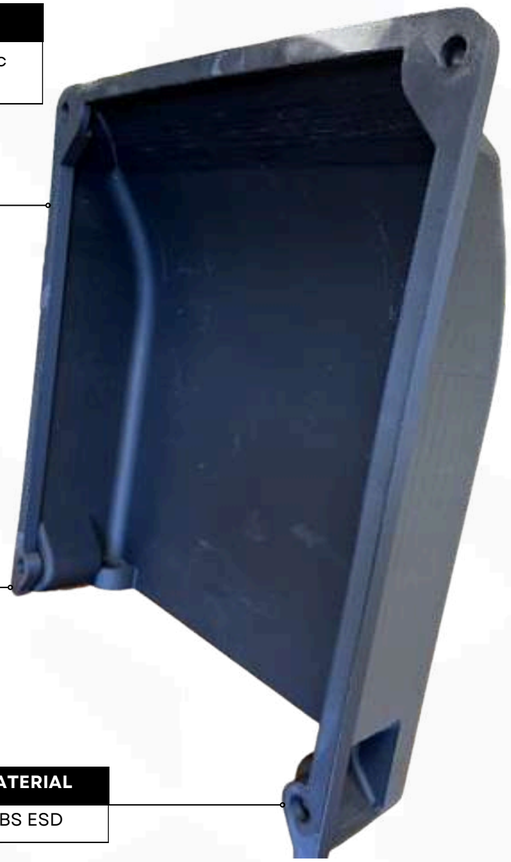
ELECTRIC MOTOR COVER REPLACEMENT

John Cockerill

OMNI TECH

APPLICATION

Replacing Electric Motor Cover



DIMENSIONS

410x480x120 mm

MATERIAL

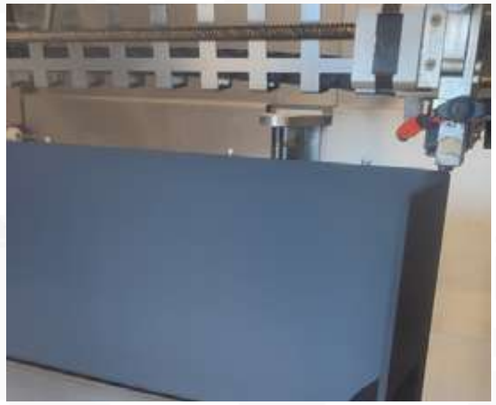
ABS ESD

PROBLEM

John Cockerill Services, a leader in industrial equipment maintenance, faced an urgent repair for a 200kW electric motor in the steel industry. The motor's terminal box cover was missing, leaving the terminals exposed and increasing the risk of damage. Traditional manufacturing methods such as injection molding or would have led to long lead times and high costs, especially for producing a single, custom part. Additionally, finding a material suitable for this part's specific requirements using conventional methods was a challenge.

SOLUTION

To address the problem, John Cockerill Services turned to OMNI3D's large-format FDM 3D printing technology. They quickly produced a first PLA **prototype within 43 hours** (10 hours design + 33 hours printing), allowing them to validate the fit and design. The final part was printed using ABS ESD material, known for its strength and static dissipation properties. The cover, was completed in 145 hours. This 3D printing solution drastically reduced downtime, was more cost-effective than traditional methods, and led to broader adoption of 3D printing for large-format parts in their repair processes.



Manufacturing

OMNI3D

Tooling

GLUE DISPENSER

APPLICATION

Production tools and assembly aids

MATERIAL

THERMEC™ ZED

OMNI TECH

PROBLEM

Volkswagen's factory in Poland faced the challenge of improving the production process for assembling window panes into car bodies during the production of the Crafter model. The robotic arms used in the process required a customized dosing nozzle to apply a primer with high precision. This nozzle had to be **resistant to high temperatures and corrosive chemicals** found in the primer. Traditional manufacturing methods were slow and costly, making it difficult to maintain efficiency and adaptability in the production process.

SOLUTION

To overcome this challenge, Volkswagen turned to OMNI TECH 3D printer and used the advanced THERMEC™ ZED filament. The dosing nozzle was 3D printed, designed to perfectly fit the robotic arms and withstand the harsh chemical environment. THERMEC™ ZED provided high temperature and chemical resistance, crucial for maintaining nozzle integrity while applying the primer. With 3D printing, Volkswagen was able to quickly prototype, iterate, and produce the nozzle, drastically speeding up the process and enhancing overall production efficiency. This solution not only streamlined their manufacturing but also enabled faster integration of technological advancements.

Manufacturing

OMNI3D

Tooling

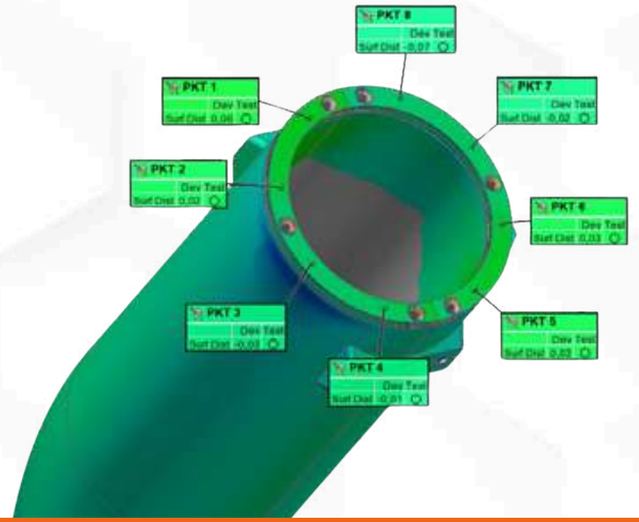
PRECISION CUTTING JIG

Collins Aerospace

OMNI TECH

PROBLEM

Collins Aerospace, a leader in aerospace and defense technologies, faced significant challenges in ensuring the precision and repeatability of components used in aircraft fuel systems. Traditional metal jigs, which were heavy and bent, were proving inadequate for the precise cutting required for aircraft fuel pipes. These metal jigs were cumbersome, increasing production costs and lead times while also impacting the consistency and quality of the manufacturing process. The difficulties in handling and transporting these jigs further compounded the issues, leading to inefficiencies and delays.



SOLUTION

OMNI3D addressed these challenges by developing an innovative 3D-printed housing jig, weighing only 2kg, with metal end caps for added durability. This jig was crafted using OMNI3D's advanced printing technology, ensuring unmatched precision and repeatability. The **lightweight design of the jig improved portability and ergonomics**, eliminating the need for additional transport aids and simplifying the operational workflow. Furthermore, the jig significantly **reduced production costs by approximately 80%** compared to traditional metal fabrication methods. By enabling quicker delivery and enhancing accuracy, the 3D-printed jig helped Collins Aerospace maintain high manufacturing standards and adhere to production schedules, despite ongoing supply chain challenges.

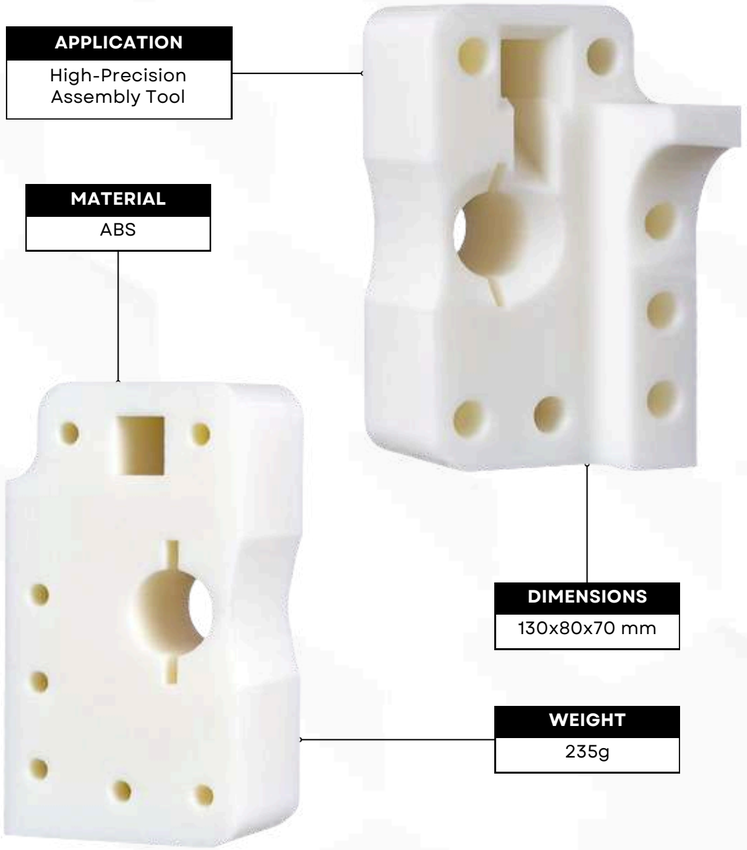
Maintenance

OMNI3D

Tooling

TOOL TO OPTIMIZE THE ASSEMBLY PROCESS

SAMSUNG



PROBLEM

Samsung required a highly accurate guided tool to optimize the assembly process of a key component for their washing machine production line. The tool needed to withstand physical impact during the assembly process while maintaining precise dimensions for effective use. Traditional manufacturing methods would have been both time-consuming and costly, particularly for producing a custom-designed tool with such stringent accuracy and durability requirements. Additionally, Samsung sought a solution that balanced low production costs with rapid delivery, ensuring minimal downtime on the production line.

SOLUTION

Omni3D responded to this challenge by utilizing the Omni TECH 3D printer and selecting ABS-42 as the material of choice. ABS-42 was chosen for its reliability, strength, and suitability for withstanding physical impact. The material also offered a cost-effective solution while allowing for rapid production. The Omni TECH's active heated chamber and cooling system enabled precise control over shrinkage, ensuring high repeatability and accuracy. The printed **tool was delivered within 6.5 hours and weighed 235g**, offering a lightweight yet durable solution. After successful testing on the production line, the tool fully met Samsung's expectations, optimizing the assembly process and significantly reducing costs.

OMNI TECH

Manufacturing

OMNI3D

Tooling

DIMENSIONING TOOLS FOR PRODUCTION

MEYRA®

OMNI TECH

APPLICATION
Measuring tool for production processes

MATERIAL
PET-G

WEIGHT
270g

PROBLEM

Meyra, a leading wheelchair manufacturer, traditionally produced dimensioning tools for quality verification using CNC machining. These tools ensure that wheelchair components fit together with precision by checking the accuracy of diameters and angles. However, this method was costly and time-consuming. With increasing demand and the need to reduce production costs, Meyra sought a more efficient and cost-effective way to produce these tools without compromising on precision.

SOLUTION

Meyra explored the potential of 3D printing using OMNI3D's Omni TECH printer. By switching to additive manufacturing with PET-G-32 material, they produced highly accurate dimensioning tools at a fraction of the cost. The 3D-printed tools maintained the necessary precision for verifying component dimensions, ensuring that only parts meeting stringent standards were included in the final wheelchair assembly. With a **production cost reduction of 86% compared to traditional CNC methods**, Meyra successfully verified the effectiveness of 3D printing and now leverages it for tooling production.

Manufacturing

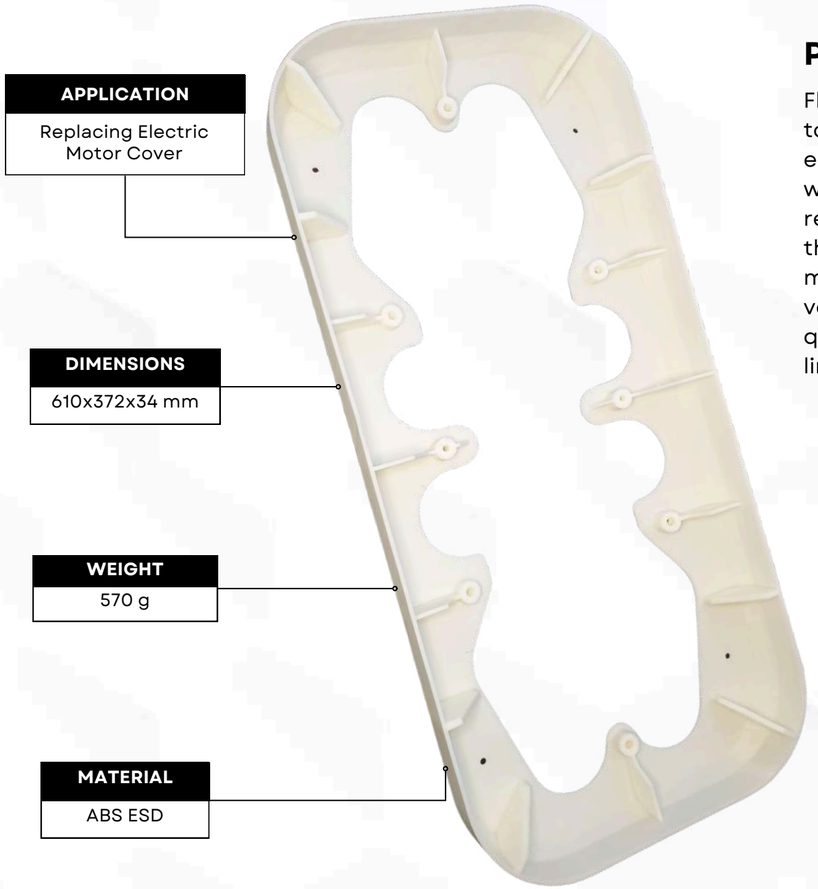
OMNI3D

Low Volume Manufacturing

SAFETY COVERS FOR ROBOTIC ARM

FLEXLINK®

OMNI TECH



APPLICATION
Replacing Electric Motor Cover

DIMENSIONS
610x372x34 mm

WEIGHT
570 g

MATERIAL
ABS ESD

PROBLEM

Flexlink, a global leader in manufacturing automation, needed to prototype and customize safety covers for robotic arms to ensure their safe integration into collaborative environments with human workers. These covers had to meet strict requirements for strength, size, and weight to protect both the machinery and the operators. Traditional manufacturing methods were too slow and costly for prototyping and low-volume production, making it difficult for the company to quickly implement new solutions on its automated production lines.

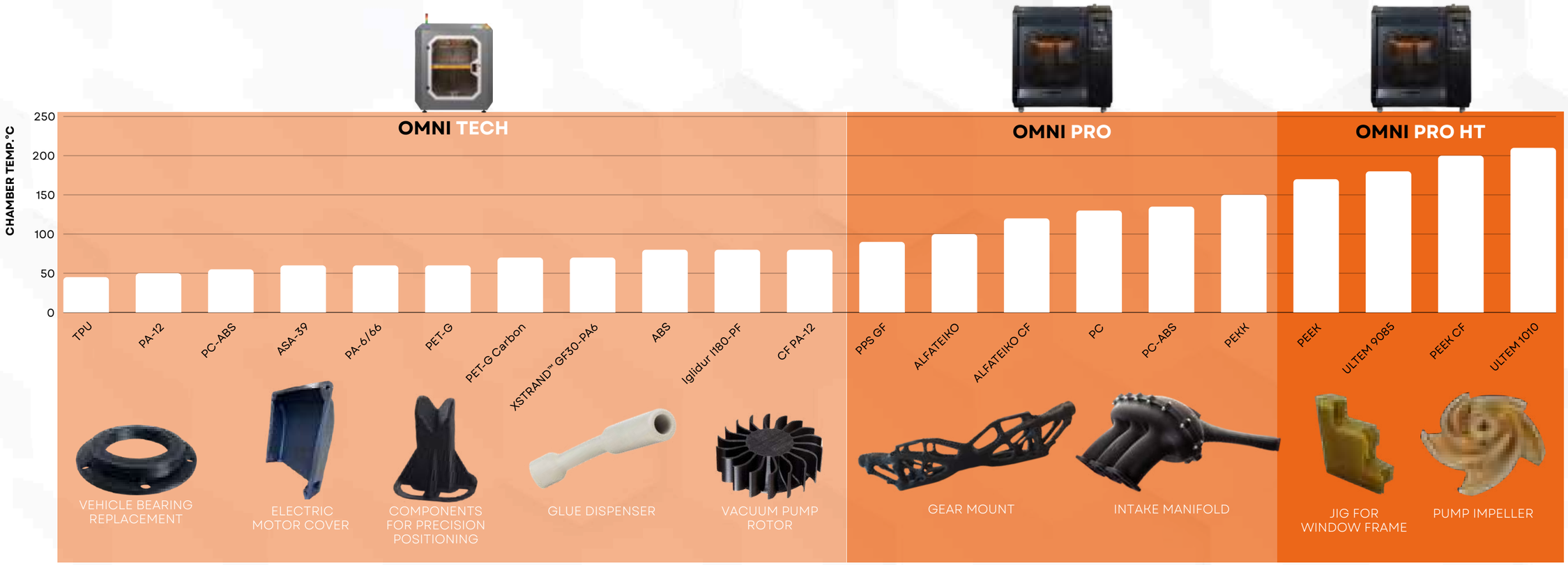
SOLUTION

Omni3D used the Omni TECH printer to develop a 3D-printed cover that met Flexlink's precise requirements. The team chose ABS-42 filament for its strength and durability, with a 25% model infill to ensure the necessary structural integrity while maintaining a lightweight design. The controlled temperature environment of 50°C enabled reliable and consistent printing, ensuring that the part could be used in Flexlink's industrial applications. The use of 3D printing allowed Flexlink to reduce the costs of mold creation and accelerate the implementation of new designs.

EXPANDING MATERIAL HORIZONS FOR DIVERSE APPLICATIONS

OMNI3D

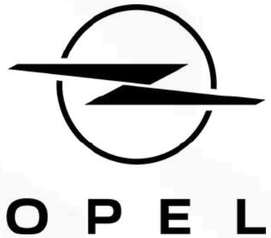
Omni3D printers offer a wide range of material compatibility, ensuring the perfect solution for any specific applications. While our EN 45545 certified materials cater to the stringent requirements for end-use railway parts, the Omni3D material portfolio allows you to explore a broader spectrum of engineering polymers.
Discover the extensive selection of CF-reinforced materials, PAs, elastomers and high-performance polymers compatible with our 3D printers.



***PEEK and ULTEM (PEI)**: High-Performance Alternatives to Metal.
PEEK and ULTEM are advanced thermoplastics known for exceptional heat resistance, chemical stability, and mechanical strength. These materials enable the creation of 3D printed parts that can replace metal components in demanding applications, offering advantages in weight, cost, and corrosion resistance.

TRUSTED BY:

OMNI3D



OMNI3D

PRINT LARGE FUNCTIONAL PARTS

Get in contact with us:

sales@omni3d.com

OMNI3D Sp. z o. o., ul. Świętego Michała 43, 61-119 Poznań, Poland

+48 61 666 12 34
www.omni3d.com

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