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The Importance of Additive Manufacturing in Railway Technology

By Stefan Genz



Additive manufacturing is playing an Aincreasingly important role in various industries, especially in railway technology.

Conjuring up scarce and expensive spare parts at short notice for goods with a long service life is a major challenge. 3D printing offers a solution to the problem of how to efficiently replicate parts and, consequently, to improve the supply of spare parts. After all, the ability to produce small quantities quickly and costeffectively is often crucial. The mass printing of quality components is now set to be enabled through certification by TÜV NORD in accordance with the new DIN EN ISO/ASTM 52920:2023 standard. "Additive manufacturing allows companies to ensure their vehicles are available because they can produce spare parts on-demand. This makes economic and ecological sense, because no transportation is involved," says Dr Stefan Pöting, Director of the Business Field Rail. Reliable and repeatable processes in production preparation, additive printing itself and component post-processing are all critical. "The new DIN EN ISO/ASTM 52920:2023 test standard puts the industrial use of 3D printing on a secure footing in quality terms and is a real quantum leap for the industrial use of the technology," says Jens Groffmann, Project Manager for Additive Manufacturing at TÜV NORD. During certification by TÜV NORD, all production steps are reviewed, from planning and the handling of



the starting materials through to actual production and post-processing. Also considered are the quality assurance measures taken throughout the entire process chain. Companies which are granted DIN EN ISO/ASTM 52920:2023 certification can demonstrate their successful transition from the single-part production of prototypes by skilled labour to efficient industrial manufacturing worldwide.

As one of the first companies in the world to issue certifications in accordance with ISO/ASTM 52920:2023, TÜV NORD has successfully certified Deutsche Bahn's additive manufacturing facility in Neumünster. Other interested parties are currently also aiming for certification. To date, Deutsche Bahn has fitted around 100,000 3D-printed components – mainly wear or bottleneck components such as seat trims and lamp holders plus components for ventilation and air conditioning systems.

DigiZug3D

In the future, however, companies in the industry also aim to additively manufacture safety-relevant metal components and use them as replacements for components which require approval and verification. The use of additively manufactured components is currently limited to non-safety-critical components. The conditions which would allow safety-relevant components to be approved and certified as well are currently being investigated in the 'DigiZug3D' project, in which TÜV NORD is also involved. 3D-printed safetyrelevant metal components currently have to undergo a time-consuming individual acceptance process. As things stand, there is no binding calculation basis for component design and the provision of mathematical proof of component strength. The 'DigiZug3D' project, funded by the EU and the German Federal Ministry for Economic Affairs and Energy, is intended to remedy this lack while also simplifying and accelerating the approval procedure itself. The railway industry is very interested: Also involved along with DB are Hamburger Hochbahn, Hamburg's biggest public transport provider, Austria's largest railway company, Österreichische Bundesbahn, and the railway vehicle manufacturer Siemens. The project started in October 2023 and will run for three years. "This is currently all still in its infancy, but, in the best-case scenario, the process, once developed, will become a blueprint and open up the possibility for other industries to produce

safety-relevant components using 3D printing," Mr Groffmann says.

The further development of additively manufactured components and their processes will be beneficial for many other industries. Sectors that operate expensive machines with long service lives or require complex components in small quantities at short notice will especially benefit. This applies to areas such as the pharmaceutical industry, the chemical industry, medical technology and aerospace. The possibility of producing spare parts promptly and in small quantities is also economically attractive for lorry manufacturers, bus builders and motorhome manufacturers, among others, as there are very many vehicle versions in these sectors. This will also pave the way to storage and transport cost savings for potentially unnecessary components, among other things. "DIN EN ISO/ ASTM 52920 also offers an enormous competitive advantage for suppliers of additively manufactured components. The independent verification of their production processes by TÜV NORD will enable certified manufacturing companies to supply high-quality components in the industrial series production context. This will give their customers security when it comes to awarding contracts and clearly set them apart from pure prototyping companies," says Mr Groffmann.

Norms and standards for the implementation of a digital product passport are currently being developed to bring about even more transparency in the manufacturing process for additively manufactured components. The intention here is to improve the traceability and security of the information provided. *"The standardisation of data formats and creation of interfaces is fundamental to ensuring interoperability between different systems,"* says Dr Pöting.

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