

Pressemitteilung

Voith Turbo GmbH & Co. KG
Alexanderstraße 2
89522 Heidenheim, Deutschland
Tel. +49 7321 37-2802
Fax +49 7321 37-7110
www.voith.de

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Voith Lightweight Components: New Energy Absorbers Made of Fibre Composite Plastics

At this year's InnoTrans, Voith introduces a lateral energy absorber made of glass fibre reinforced plastics (GFRP) and aluminum. Compared with standard steel absorbers a weight reduction of 60 percent could be achieved. This new lightweight energy absorber is part of the mutable vehicle head concept Galea, but it can just as well be integrated into other front end systems. The crash energy systems focus on vehicle safety and efficiency, as well as ecological benefits through a reduction of CO₂ emissions. Their modular design allows short replacement times and an individual vehicle design.

GFRP Energy Absorbers: Saving Weight and Mounting Space

Train front ends have to bear extreme loads when impacts occur. Therefore, they need to be provided with special structural and energy absorbing components. The new GFRP energy absorber by Voith comprises a fibre composite crash tube, along with a bearing and an anti-climber plate, both made of aluminum. They excel in corrosion resistance and longevity, complying with the fire protection requirements according to EN 45545-2:2013, class R7/HL3.

The main characteristics of this absorber are a constant energy absorption behavior, a low total weight and an outstanding energy to weight ratio. Its total weight of only 70 to 95 kg means weight savings of 60 percent compared with standard steel absorbers. For a vehicle equipped with four absorbers, this amounts to 600 kg less weight.

This lightweight solution does not only bear economic and ecological benefits, other strong features are its size and the required mounting space. In case of a crash, the crash tube defibrates and thus can be easily deflected below the vehicle underframe. This way, the mounting space

behind the absorber can be reduced to 30 cm. For force levels between 600 and 1600 kN at a maximum consumption length of 1000 mm, it can be exactly adapted to the customer's requirements.

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Galea Vehicle Head and Front End Systems: Modular and Custom Made

The new energy absorber is part of the mutable Voith vehicle head Galea. It has been designed for intercity railway transportation and consists mainly of glass fibre reinforced plastics (GFRP). This makes the Galea a lightweight solution compared with steel front ends, considerably reducing the vehicle's fuel consumption. Furthermore, the axle load and thus the wear of train and tracks are minimized, or – respectively – the load capacity of the train is increased. Its modular and flexible concept makes the Galea a standard platform for all types of exterior designs. Mounting and replacement times are minimized, and with them the train's downtimes. In terms of safety, the Galea integrates an energy absorption concept according to the EN 15227 standard, also taking into account further requirements such as the fire protection standard for rail vehicles (prEN 45545-2:2013).

Seite 2 von 4

Apart from the Galea, Voith also shows the front nose of the new ICx high speed trains of Deutsche Bahn (German Railways). From 2016 on, these will gradually replace first the current Intercity/Eurocity trains and later the ICE1 and ICE2 vehicles. Weight reduction and energy savings have been realized through new developments in aerodynamic design and an optimum exploitation of the floor space.

Apart from the weight benefits, fibre reinforced plastics also allow the forming of complex geometries and free-form surfaces. This way, aerodynamic surfaces as well as specific geometries of the vehicle can be realized in an easy and cost-saving way.

CFRP Adapter Couplers: Compact and Easy-to-Fit

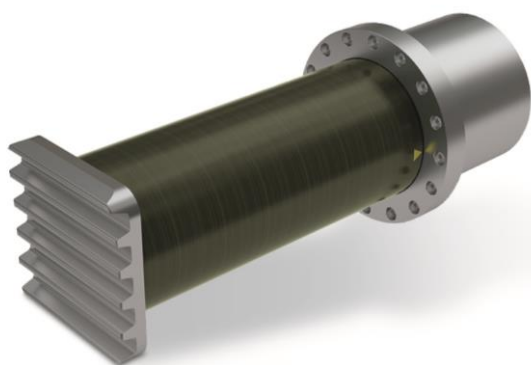
Adapter couplers are used whenever a train needs to be towed, and legal requirements state that every train needs to have one on board.

For conventional steel couplers, the possibilities of weight reduction for this type of coupler have long since been exhausted. With their adapter coupler made of carbon fibre reinforced plastics (CFRP), Voith went along different lines. So far, this lightweight material has mainly been used in aviation technology. For the adapter coupler the use of this material means a weight-reduction of nearly 50 percent, leaving 23 kg for the coupler. This

way, it can be carried and mounted by one person alone. Since adapter couplers are mostly used in emergency situations and must be fitted by the train personnel on short notice, this saves a lot of time and effort. What is more, CFRP requires distinctly less material thickness for achieving the same strength characteristics the standard steel coupler provides. This represents an additional plus when thinking of the usually restricted mounting space of the vehicle front and the depository of the coupler in the train.

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Seite 3 von 4



Voith GFRP energy absorber: 60 percent weight reduction compared with standard steel absorbers



The compact CFRP adapter coupler can be carried and fitted by one person alone



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Seite 4 von 4

Voith front end for the new ICx intercity trains of Deutsche Bahn (German Railways)

Voith Turbo, a Group Division of Voith GmbH, is a specialist for intelligent drive solutions. Customers from highly diverse industries such as oil and gas, energy, mining and mechanical engineering, ship technology, rail and commercial vehicles rely on advanced technologies from Voith Turbo.

Voith sets standards in the markets energy, oil & gas, paper, raw materials and transportation & automotive. Founded in 1867, Voith employs more than 43 000 people, generates €5.7 billion in sales, operates in about 50 countries around the world and is today one of the largest family-owned companies in Europe.

Contact:
Nadine Queiser
Internal & External Communications
Telephone: +49 7321 37 2802
Nadine.Queiser@voith.com