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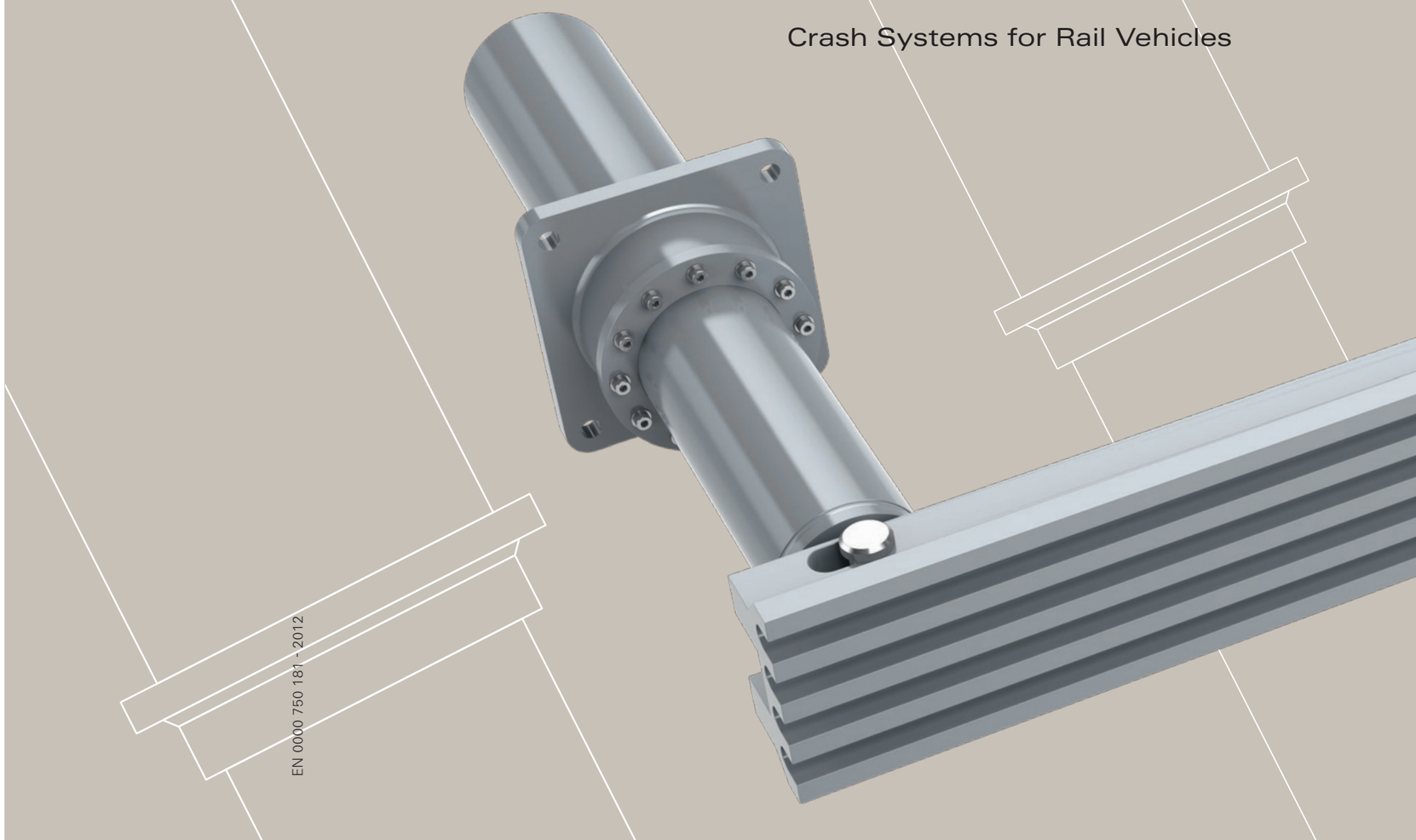
Safety and Efficiency

Crash Systems for Rail Vehicles



EN 0000 750 181 - 2012

Driveline and Chassis Technology

Safety and Comfort for Your Trains. With the ZF Crash System.

Your rail passengers expect to enjoy a very comfortable and safe trip. In order to meet precisely such expectations, rail vehicles have to meet mandatory standards. In 2012, the EN 15227 standard has become effective, and you have to meet a high level of collision safety for every one of your vehicles.

This binding standard confronts train manufacturers and operators with major challenges. In order to ensure profitable operations, they have to integrate a solution into their existing and new vehicles that is both economical and efficient.

ZF meets this challenge with innovative technology that is being used for the first time on rails. The foundation for this system is the experience gathered by the ZF Group over decades in developing and producing crash systems for passenger cars. Proven millions of times on the roads, this product helps to minimize the consequences of collisions and to keep passengers safe. It provides the best possible protection – for the moment that hopefully will never come.

One Crash System for all Requirements

The ZF crash system is more than the sum of its parts. The individual products that form the ZF crash system can be mutually tuned to each other. This means that ZF delivers a specially adjusted product package to meet individual customer requirements for every coach body stiffness.

The core piece of this highly efficient system is its hydrodynamic impact absorbers, whose operating principle has proven itself for years already in passenger cars. Another element of the ZF crash system is the energy absorbers that each consists of a set of combined impact absorbers. With a degree of efficiency of up to 95 percent, they effectively absorb collision energy and convert it into heat. This enables the EN 15227 standard to be met even under unfavorable conditions.

Depending on the required force level and on the type of rail vehicle, as many energy absorbers can be used as desired. This flexibility allows the ZF crash system to be used in all rail vehicles – from trams to heavy-duty locomotives to high-speed trains.

Source: Vossloh

Tested by...

A neutral testing institute, the TÜV SÜD in Germany (German Technical Monitoring Association), has checked the reversible and irreversible crash function of our crash system for force level, different setting parameters and function according VDV152 und EN 15227 and confirmed them positively.

Safety That Sets new Standards

As train travel becomes ever more popular and the average speed of rail vehicles keeps increasing as well, the demands placed on train safety are rising, too. This has led to EN 15227, a standard that has become effective throughout Europe in 2012, and which prescribes precise requirements for the passive safety of rail passengers and crew. For train manufacturers and operators, this means that each of their vehicles must have a crash system on board.

Here, the ZF solution offers numerous advantages over other products available on the market. These advantages are based in large part on the way in which the hydrodynamic impact absorbers work. They react as a function of the collision forces and provide a modulated response starting with the first contact. Light pushing movements that can occur when maneuvering are absorbed in the reversible function range, whereas if strong collisions should occur, the dampers' irreversible function range comes into action. Force levels for the reversible and irreversible crash ranges can be individually specified. This design enables the prescribed force-path diagrams to be put into practice. Yet, another advantage is that the ZF crash system enables maximum energy absorption at a low weight.

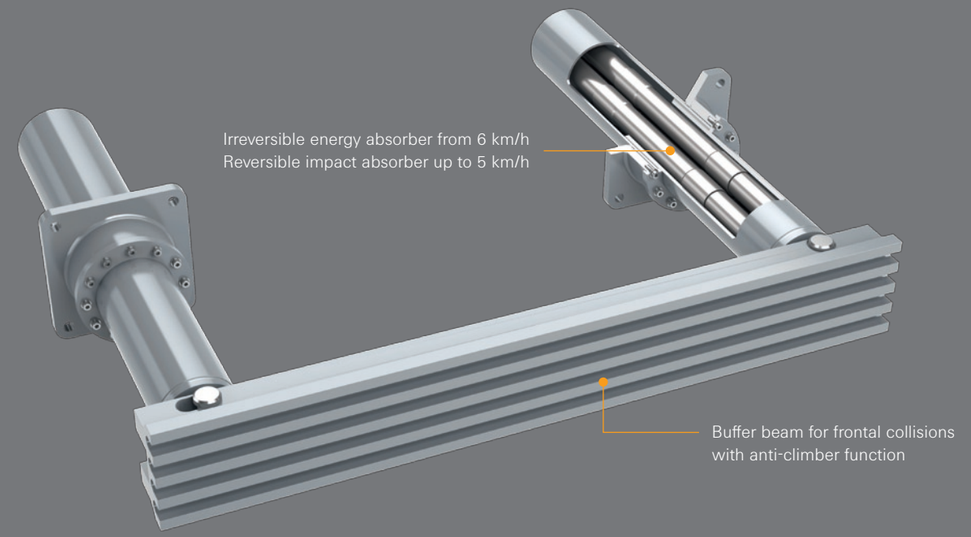
ZF-Crash System

Benefits

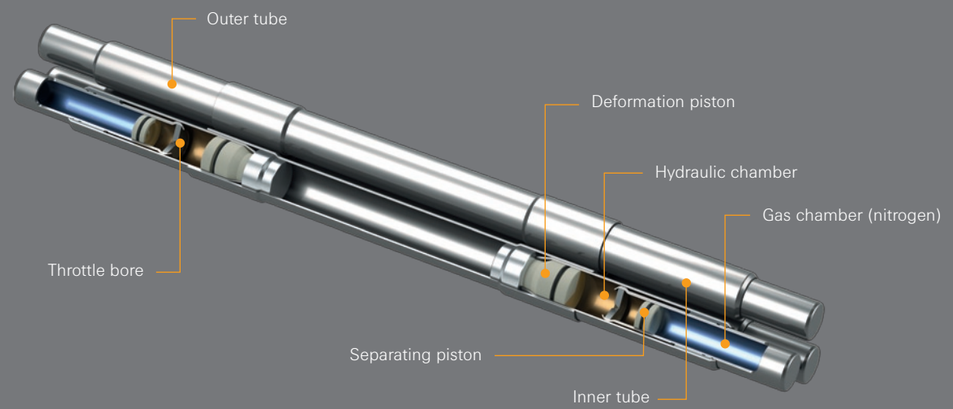
- Deformation elements in compliance with EN 15227
- Reversible function according VDV 152
- Integrated anti-climber protection EN 15227
- High energy efficiency
- Customer specific adjustable force level
- Tested by TÜV [German Technical Monitoring Association]
- Proven product

Free Choice:
Complete Crash System or Single Energy Absorbers

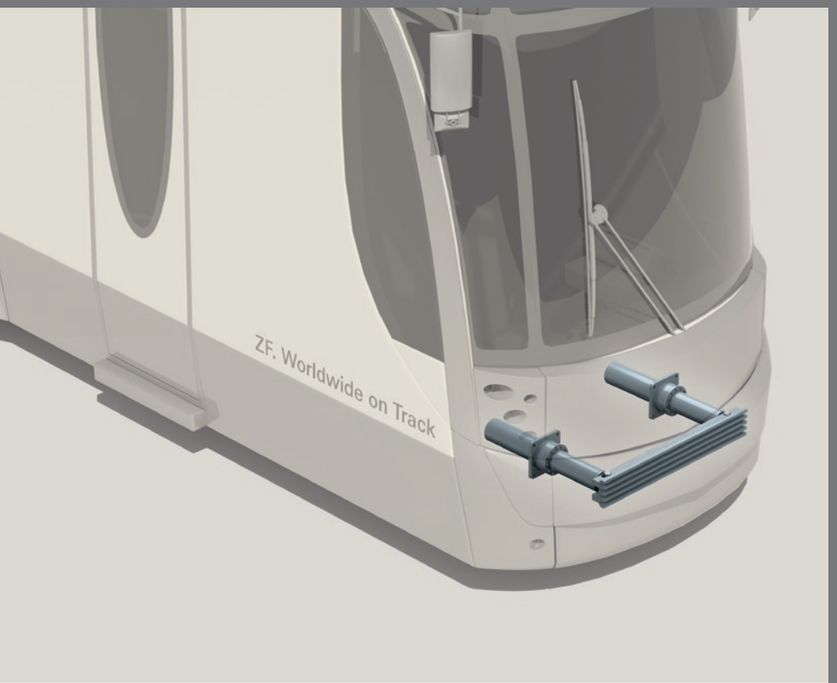
Design of a Crash System



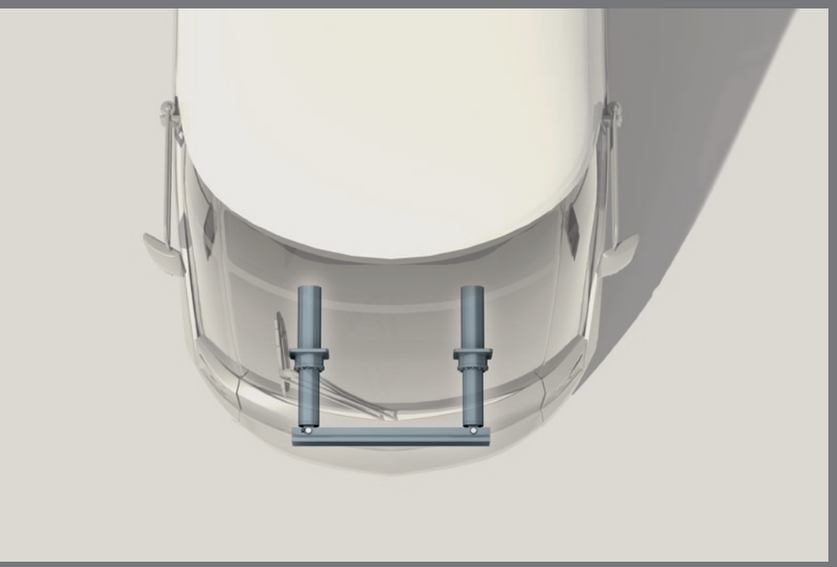
Design of an Impact Absorber



This impact absorber system has proven itself millions of times in the passenger car sector – ZF has been supplying the automobile industry with this damper type since 1973 already. The dampers consist of an outer and an inner tube, which slide into each other in the event of a collision. The two tubes enclose a hydraulic chamber filled with fluid and another chamber filled with pressurized gas, which are separated from each other by a movable separating piston. The materials and tolerances have been specially adapted for the high requirements in the rail industry. The torsion-resistant telescope guide made of high-grade aluminum or precision steel features the highest stability and service life.

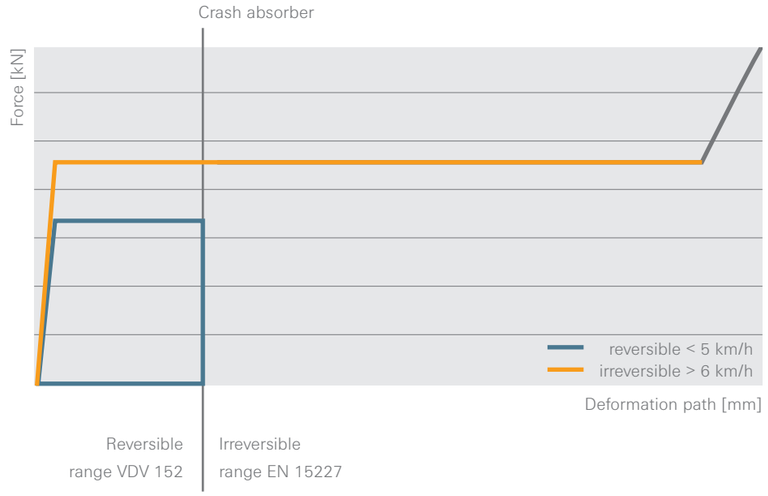


The connection of the ZF Crash System to the power rail can either be done according to standard (EN 15551) or customer specification. This is also the case for the anti-climber, which can be implemented as a connecting element between the energy absorbers or as an individual body. For the highest possible stiffness at a low weight, ZF also supplies the combination with a center support.



Cost Benefits and Shorter Down Times

Light pushes, which can occur when parking or maneuvering, for example, are absorbed by the impact absorbers' reversible function range in accordance with VDV 152. In so doing, the inner tube is pushed into the outer tube and the fluid streams through an opening into the gas chamber. This compresses the gas and moves the separating piston and the impact forces are absorbed. The impact absorbers themselves do not sustain any damage and are quickly returned to their starting position.



Serious Safety

High energy levels are absorbed by the impact absorbers' irreversible range. In such cases, the fluid cannot enter the gas section at a sufficiently high speed, so the deformation piston which has thus far served as the wall of the fluid chamber moves through the compressed outer tube, which effectively converts the impact energy into heat. Following this type of collision, the impact absorber needs to be replaced.