



ZF cabin suspension and damping – the right solution for every challenge

- **Different configurations to meet any customer requirements**
- **ZF products increase tractor safety and ride comfort**

Outstanding work conditions in the driver's cabin are becoming increasingly important for the success of agricultural vehicles. To increase ride comfort under the respective driving conditions, ZF's spring damper units are the perfect solution for almost any tractor application, whether as a steel spring module or as NivoCab with autonomous level control, whether as air spring module or with integrated height leveling as eCALM. An electronically controlled solution is offered by the CDC damping system.

Mounting tractor cabs on spring damper units has long been a market standard. This approach was originally used for premium performance class vehicles exclusively, and for a long time, remained more the exception in the medium performance class segments. Nowadays, vehicles without this mounting concept are no longer competitive. Among the many dynamic driving challenges, ZF has met the increasing demand for greater driving comfort by developing innovative spring and damping technology. Together with its customers, ZF is setting standards for effectively controlling driver's cab movements. Drivers are seeing a noticeable improvement in workplace comfort. The steel spring module (image 1) is standard equipment for commercial vehicle cabs in the construction, tractor and special vehicle sector. Advantages are that they are easy to assemble in the vehicle, they have compact dimensions and demonstrate robustness. Moreover, they work independently from other systems such as compressed air, sensors, etc.



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NivoCab: steel spring with autonomous level control in the damper

Changing load conditions in the driver's cabin present huge challenges for the cabin suspension and the driver. The change in weight in the driver's cabin causes the vibration behavior to change, which in turn influences the driving experience when mechanical cabin suspensions are involved. Restricted suspension travel afflicts the level of comfort. It can also lead to an earlier contact with the cabin end stops in certain driving situations.

NivoCab, ZF's fully-automated, hydro-pneumatic level regulation system, counters the negative effects caused by varying loads. NivoCab provides a unique combination of leveling function, suspension and load-dependent damping. NivoCab replaces conventional spring carriers and is installed in the cabin suspension, which in turn allows retrofitting. Even on short distances, this compact device pumps the driver's cabin to the ideal height, fully automatically and without the aid of electronics. Instead, NivoCab draws the required energy from the relative motion between the chassis and the driver's cabin. This maintenance-free system adjusts the driver's cabin to the ideal level for every load condition and thus ensures a safe and comfortable driving experience.

Air springs for sophisticated demands

Other comfort gains can be achieved with the air spring module configuration (image 2). It is particularly suited for installation in vehicles with high load differences in the driver's cab. It supports level compensation for different driver's cab configurations and enables very comfortable damping and suspension behavior.

eCALM: Air spring with electronically controlled height leveling

With eCALM, additional new features such as leveling, lowering and raising the cabin to different levels are can be offered. Ergonomic driving with slope compensation offers additional benefits such as access to difficult-to-reach components in the service position. The pneumatic cabin suspension for driver's cab applications has considerably reduced energy consumption in the vehicle due to the new electronic control unit. This means that the entire air system



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(compressor, accumulator, drier) can be designed to be smaller and lighter in weight. There is the option of also having the compressor operated electrically by integrating it into the eCALM system which means it actuates based on need. In vehicles without a centralized compressed air system, eCALM and its integrated compressor can generate air suspension in the driver's cab.

Healthier, safer and more comfortable thanks to the electronically controlled damping system CDC

The requirement for cabin damping is complex. On the one hand, driver comfort and vehicle support must be provided while ensuring sufficient stability in the driver's cab. Setting a conventional damper is therefore always a compromise because too little damping is better for driver comfort while too much damping improves stability.

This is where ZF's electronically controlled damping system CDC comes into play. Successfully used for years in passenger cars and commercial vehicles, it has now been customized for use in driver's cabin damping in tractors. The sensors permanently monitor all factors that influence driving conditions, including driver activity and vehicle movements. The electro-magnetic proportional valve on the CDC damper adjusts the damping force to the respective situation in a matter of seconds. The ECU calculates the optimum damping force for the respective driving condition and adjusts the damping force accordingly. The system optimally dampens the cabin movements according to the Skyhook principle.

The advantages of CDC are obvious – it enhances driver comfort substantially, for example, when operating conditions are constantly changing (field, road, etc.). Sensitive electronic components in the cabin are protected, maintenance costs and the risk of breakdown are reduced. Dynamic adjustment of the damping force reduces the stresses on the driver. Efficiency improves over time and the stress on the driver drops noticeably



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Ride comfort in the tractor's driver cabin is not a luxury, rather a requirement for the driver to operate the vehicle safely and attentively. As a system supplier, ZF offers cabin suspension systems for all tractor applications – and it consists of springs, dampers and rubber-metal components. The individual cabin suspension components are attuned to one another right down to the last detail. Customers receive tailor-made solutions that match their respective requirements. Drivers benefit from a considerably more comfortable workplace with minimized cabin movements.

Captions:

25) NivoCab®- Autonomous Level Control for Cabin

26) eCALM® - Cabin Air Leveling Module

27) CDC® - Continuous Damping Control

Images: ZF

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ZF Friedrichshafen AG

ZF is a global technology company and supplies systems for passenger cars, commercial vehicles and industrial technology, enabling the next generation of mobility. With its comprehensive technology portfolio, the company offers integrated solutions for established vehicle manufacturers, mobility providers and start-up companies in the fields of transportation and mobility. ZF continually enhances its systems in the areas of digital connectivity and automation in order to allow vehicles to see, think and act.

In 2018, ZF achieved sales of €36.9 billion. The company has a global workforce of 149,000 with approximately 230 locations in 40 countries. ZF invests over six percent of its sales in research and development annually.

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