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## **ContiTech Railway Engineering** Expertise for the world's railways



Whether it be on metros, trams, regional or high-speed trains, ContiTech Railway Engineering, as a development partner and OEM, can offer extensive expertise when it comes to innovative spring concepts for shock absorption and soundproofing.

# Trains a global hit, and for good reason

## Innovative, safe and comfortable

**Every day, millions and millions of people all over the world travel by rail. From metros, to trams, to regional and high-speed trains. With increasing standards in comfort and safety. Fully aware of this responsibility, manufacturers are building on the innovative spring concepts introduced by ContiTech Railway Engineering - the specialists in advanced spring technology.**

For over 60 years, we at Air Spring Systems have been skilfully and passionately working on future-oriented solutions to improve public transport. Whether it be three stops by metro to work, or to the other side of the country by high-speed train, we want every passenger to reach their destination as conveniently and reliably as possible.

To do this, we develop trendsetting spring concepts for shock absorption and soundproofing in worldwide local and long-distance transport. Over the years, our primary and secondary spring systems have made travelling by rail and train an increasingly pleasant and quiet experience. Not to mention faster, safer and more reliable.

Each of our developments is put through its paces under authentic, real-life conditions in our certified testing laboratory - for maximum performance under extreme strain such as heat, cold or high speed.

As a full-service partner, we work closely with our partners to create customised, individual solutions - from material development, to product tests, sample production and series production, to assembly and all necessary servicing and maintenance.

**All over the world, ContiTech Railway Engineering stands for**

- Recognised global market and technological leadership
- Creative innovation
- The highest standards in functionality and safety
- A full product range for all areas of application
- Customised, individual solutions
- Qualified full service, from the initial request to series production
- Highly accurate measurement and simulation processes
- Guaranteed reliability and availability of products and services
- Global customer focus through on-site presence in important markets
- The world's only independently certified test laboratory
- Reliable spare parts business


# Everything under one roof: Right from the start

## Full service on site

To make things as easy, comfortable and safe as possible for our customers, we provide full spring sets for entire modules directly and “just in time”, offering help and advice right from the initial planning phase. Throughout the entire project, we ensure on-site support, and guarantee customer goods are supplied close by. It doesn't matter whether it's for small series or large-scale projects - we don't distinguish.

SWING bogie example: For this train module, we and our local partner Trans-Comfort supply the manufacturer PESA with the full spring kit: primary springs, laminated elastomer springs, pivots, lemniscate linkage, bumper stops, and rod connectors.

If requested, we also supply additional products such as shock absorbers and steel springs, thereby offering the most effective form of full service.



When it comes to trams, PESA uses the full ContiTech spring kit for the SWING bogie.

Our services are of course governed by the recognised high ContiTech standards in efficiency and quality. To ensure we can also produce small series in a cost-conscious manner, we look out for identical structures in comparable applications wherever possible.

And we have a responsibility to our customers, our own standards and, most importantly, the constant safety of the passengers, to ensure every product is tested before delivery.

Our mission:  
Top customer  
support requires  
full service  
from the very  
first second



#### CAF CPTM Sao Paulo

Spanish manufacturer CAF has also been relying on ContiTech's consulting and product expertise for its CPTM trains in Brazil. Because with 2.7 million passengers a day, Sao Paulo's suburban train network is one of the busiest in the world.



Whether it be tropical heat or polar cold, ContiTech can find the best solution for the biggest of challenges.

# Ice cold performance: Extreme climatic conditions

## Redefining standards

Vladivostok, -40°C: Rugged up warmly, many passengers wait on the platform for the next Intercity train, which arrives punctually at the station a few minutes later. Even in extreme climate zones, the transport infrastructure must operate as reliably as it does everywhere else.

Intense cold and drastic temperature fluctuations particularly pose huge technical challenges for air spring systems, as was the case in the major project to upgrade the Russian rail network. The development stages until 2030 include network plans for routes from St Petersburg to the Black Sea, and from the Caspian Sea to Vladivostok in Siberia. At speeds of up to 350 km/h.

## Our conviction: Trendsetting solutions are the result of strong partnerships

Together with our partner, Siemens, we have found an innovative yet pragmatic solution for this, involving more than merely designing new air spring systems for extreme conditions. In order to simulate the unusual requirements, we also developed a unique test bench with a cooling chamber reaching temperatures of -50°C.

As it turned out, our new development was a real milestone in terms of robustness. We leave nothing to chance. That's the only way to successfully cope with even the more formidable of challenges.



### AnsaldoBreda

Not just sought after in the cold vastness of Russia - AnsaldoBreda has also fitted the new CDPTR double-storey carriage with ContiTech solutions for regional services in sunny Tuscany.

# Effective co-ordination: Project development in record time

## Optimum use of synergies



### Alstom LINT

Not just sought after in France: Alstom LINT trains also operate as regional trains under the name of Coradia on Germany's railways, fitted with ContiTech technology.

**The task:** Simultaneously develop secondary spring systems for two completely new regional train systems. **The agenda:** nine different product types, five of which are special, customised developments. **The time frame:** two years from the first design draft to the live test. **The planned total volume:** 1,860 sets. **The problem:** None!

Our advantage: We pool our expertise and capacities consistently, even beyond the process chain. These synergies mean we are always able to meet even unusual requirements.

Our benchmark:  
Maximum efficiency can only be achieved if all competencies are pooled intelligently

For example, we simultaneously provided our French customers, Alstom and Bombardier, with specific new secondary spring developments for the two new Regio2N and Regiolis regional rail systems.

A mini record: We had set a period of two years for development time before series production, but were able to deliver the first products for live tests in the train prototypes after just 18 months – including design phase, sample production, extensive tests in our laboratory, and the successful approval process.

This was made possible thanks to the smooth co-ordination by our engineers and production staff at six different locations, and the close collaboration with our customers directly on site.







**Pushing performance  
boundaries:  
Compact speed limit**  
Uncompromising lightweight  
construction

Inside, business people discuss the upcoming meeting over tea and snacks, while outside, the landscape whizzes by at almost half the speed of sound. 400 km/h at its peak and 350 km/h standard speeds pose extreme challenges for every single component on South Korea's "High-speed Electric Multiple Unit - 400 km/h Experiment", or HEMU 400x for short.

To guarantee maximum protection against derailment, the secondary spring system developed by us has a particularly low vertical rigidity with small amplitudes and high frequencies. The specifications provided by our customer, Hyundai Rotem, stipulated a system weighing less than 100 kilograms in total, with a space-saving structure due to the compact bogie of the HEMU 400x.



Faster, smaller, lighter, safer:  
ContiTech secondary springs  
keep setting benchmarks.

Our philosophy:  
Innovations are not  
ends in themselves,  
but must instead  
fulfil a specific use  
for our customers

In just eighteen months from customer request to implementation in the test train, we developed, tested and delivered a completely new secondary spring system meeting both the stress and the weight/size requirements. By concentrating on aluminium as the basic material, e.g. on the lower pin and on the base and top plate, we were able to significantly undercut the stipulated weight limit and create a product weighing just 89 kilograms, while strictly upholding all requirements for high-speed reliability and safety.



#### Hitachi CTRL

ContiTech high-speed technology for Europe's train services: The Hitachi fast train operates on the CTRL (Channel Tunnel Rail Link) between London and the Channel Tunnel at speeds of up to 225 km/h.

# Hard work: A tour de force between wheel and carriage

## Primary spring systems

As a link between axis and bogie frame, ContiTech primary spring products reliably perform the complex task of wheel-set mounting and bogie suspension.

In a true tour de force and under extreme strain, they minimise the effects resulting from contact between wheel and rails during the journey, competently absorbing vibrations and reducing impact sound for smooth driving operations. This particularly applies to local, long-distance

and high-speed passenger transportation, so that passengers can relax while travelling. This technology is also gaining importance in freight haulage, because it ensures smooth running and reduces noise pollution by absorbing sound.

Depending on application and specific requirements, we develop the optimum technical solution in close collaboration with the customer, achieving an ideal balance between vertical and transverse rigidity and a number of other parameters.

MEGI® springs by Phoenix guarantee good stability. Our customers also benefit from a long product lifetime and a high quality level. When it comes to life cycle costs, ContiTech products are among the best in the industry.

The most common types of construction at the primary spring level are:

### PRIMARY SUSPENSION



#### Conical springs

enable variation in lateral and vertical rigidity, guarantee excellent stability, and involve low life cycle costs.



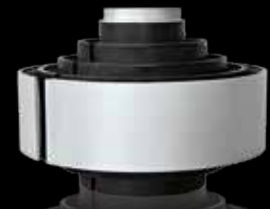
#### Axle/Chevron springs

enable a vast variation in rigidity couplings, and good stability. This space-saving solution is very popular.



#### Wheel set guide bushings

as the standard rail solution for wheel sets and power transmission in axle rockers, enable different rigidities (axial/radial) depending on customer requirements. They come in various sizes.



#### Guide springs

help guide the wheel set. They absorb lateral forces in steel spring systems.

# All about comfort: A smooth ride thanks to precise design

## Air spring systems for secondary springs

**ContiTech has been developing and producing air spring bellows and systems for rail vehicles for over 60 years.**

As an elastic link between the bogie and railcar body, they distance the railcar body from platform irregularities by minimising the transmission of vibrations. When following a curve in the track, they also enable lateral deflection in the bogie. No other technical solutions achieves such driving comfort, regardless of loading.

Another advantage of our spring technology: With a constant, adjustable height, the railcar body can also maintain an ideal distance from the platform, meaning passengers can board and disembark the vehicle safely and comfortably.

We create these special features at a technical level by perfectly combining an air spring bellow meeting these requirements with a precisely aligned MEGI® spring, which works as an additional spring.

When it comes to air bellows, a distinction is made between half bellows, rolling bellows, belted bellows and double convolution bellows. MEGI® springs are used as additional springs. The half-hourglass spring is particularly important here.

### SECONDARY SUSPENSION



#### Half bellows

are the ideal solution for bolster-less bogies. Thanks to the possibility of vast lateral deformation, they are also perfect for high-speed trains, as well as modern bogies in local and metro transportation.



#### Rolling bellows

are used in confined constructed spaces in tram bogies and low-floor bogies.



#### Belted bellows

enable increased load-bearing capacity compared to conventional bellows when used in bolstered bogies.



#### Double convolution bellows

are the technically simplest solution for air-suspended secondary springs. They are distinguished by a high degree of reliability, and can perform large stroke movements.

## Perfectly co-ordinated: suspension and insulation

### Rubber moulded parts

#### Rubber moulded parts in wheels

Depending on the manufacturer's design, single or multi-component rubber moulded parts are used for the wheel tyre suspension. ContiTech develops and produces rubber elements distinguished by precisely co-ordinated suspension and insulation properties. On the one hand, our elements absorb the non-spring-mounted mass, and on the other, they reduce wear and tear both on the wheels and on the platform. The crucial advantage for our partners? Longer-lasting wheel sets.

#### Rubber moulded parts in couplings

Elastomer springs are used in central buffer couplings. They enable a fixed link between trains to be designed in both a horizontally elastic and vertically rotatable manner. In doing so, the Phoenix rubber moulded parts absorb the forces generated at the centre of the coupling.



Wheel set springs



Coupling springs

## Wide product range: Many different solutions

### Connectors, buffers, rods

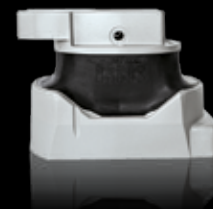
In addition to the aforementioned MEGI® primary springs, we also offer a number of other bogie products.

- Power transmission rods
- Torque supports
- Pivot pin connectors
- Connectors/spherical bearings
- Vertical and transverse buffers
- Elastic bearings for vehicle couplings



#### Rods

fitted with metallic rubber connectors are used in bogies for various purposes. The design of these connectors depends exclusively on the relevant rod's function. Conventional rods include lemniscate links, torque supports, traction links and pendulum support.



#### Frame support bearings

are most commonly used in combination with a coil spring. While the coil spring enables relatively large vertical movements, the frame support bearing provides guiding in the x and y direction. The different designs mean the rigidities in the X, Y and Z directions can be defined somewhat independently from one another.

# Maintaining contact: Bellows cylinders for pantographs

## Reliable sensor

When it comes to trains, travelling comfort is not just about comfortable seats; it's also about pleasant temperatures and sufficient lighting on evening journeys.

Whether it be for drive systems, control systems, lighting or air conditioning, modern rail vehicles operating locally and long distance obtain their energy from electricity. Pantographs on the train roof transmit the power into the vehicle interior by maintaining permanent contact with the overhead wiring.

This contact should be consistent wherever possible, even if the overhead wire height varies, e.g. through heat-related expansion, constriction in cold conditions, or as result of construction on bridges and in tunnels.



With our bellows cylinder, we have developed a future-oriented solution which guarantees optimum pantograph contact pressure with the overhead wiring in all circumstances. The internal pressure of the only 20-centimetre-high bellows cylinder can be accurately and individually set to the requirements of the different rail networks and systems, enabling perfect, consistent contact in all weather conditions and at all speeds.

Our rubber material also boasts many other advantages compared to conventional mechanical solutions: It is much lighter, longer lasting, lower maintenance, UV-resistant, and with unrivalled weather-proofing.



### Triple convolution bellows

made from fabric-reinforced elastomer materials ensure even pantograph contact pressure in every situation. A regulated compressed air supply generates the necessary power inside the bellows cylinder, and is adjusted as required.

# Original reliability: Service guaranteed

## Available worldwide

ContiTech has helped air springs break through in global rail transportation. Millions of passengers and our customers from all over the world place their trust in our know-how and experience in this field. It's a level of reliability we guarantee for a vehicle's entire lifetime.

We only supply original spare parts featuring identical properties as the first product generation. Even for customer-specific solutions. Thanks to a global network of dealers, qualified technicians and experienced fitters all over the world, our products are available at short notice and can be reliably replaced.

An exemplary catalogue of measures particularly ensures that our customers' spare-part and maintenance requirements can be planned for the long term. With competent consulting, early used parts tests, accurate laboratory measurements and early assessment of needs, we ensure service and maintenance work can be prepared systematically: in a cost-optimised manner, more than twelve months in advance.

Another advantage: We can generally deliver complete suspension kits for bogies, making the logistics processes easier for our customers, and guaranteeing the availability of all components.

### Guaranteed train availability

With our standardised solutions and industrialised production processes, we can guarantee our customers optimum train availability, exclusively original replacement parts, and therefore minimised expense - even with re-engineering requests.





# Certified quality: Competence in pushing limits

## Testing the future

**Packed suburban trains taking people to work, train trips in record-breaking Siberian temperatures, and business trips at half the speed of sound - when extreme conditions push components to their limits, not a single detail development must ever be left to chance.**

That's why we have the world's only test laboratory for air spring systems in rail vehicles, which has been officially certified as independent. Twelve test processes relevant to the rail industry have been accredited under DIN EN ISO/IEC 17025.

In the test laboratory, we scientifically simulate every conceivable situation well beyond what is actually required. We test things at their limits to redefine the boundaries of tomorrow - and thereby crucially help shape the future of rail transport through innovative solutions.

In addition to test benches for dynamic, static and even burst pressure tests, all stresses can be reconstructed and authentically tested using vehicle operation data.

We conduct characteristic curve checks and destructive tests to precisely determine product properties. And, thanks to sophisticated time-lapse tests under extreme conditions, can make binding statements on product lifetime.

All results are directly incorporated into the product development. On the other hand, we can also cater directly to our customers' requirements based on extensive test data from an accredited laboratory.

To ensure maximum safety for millions of passengers. Now and in the future.

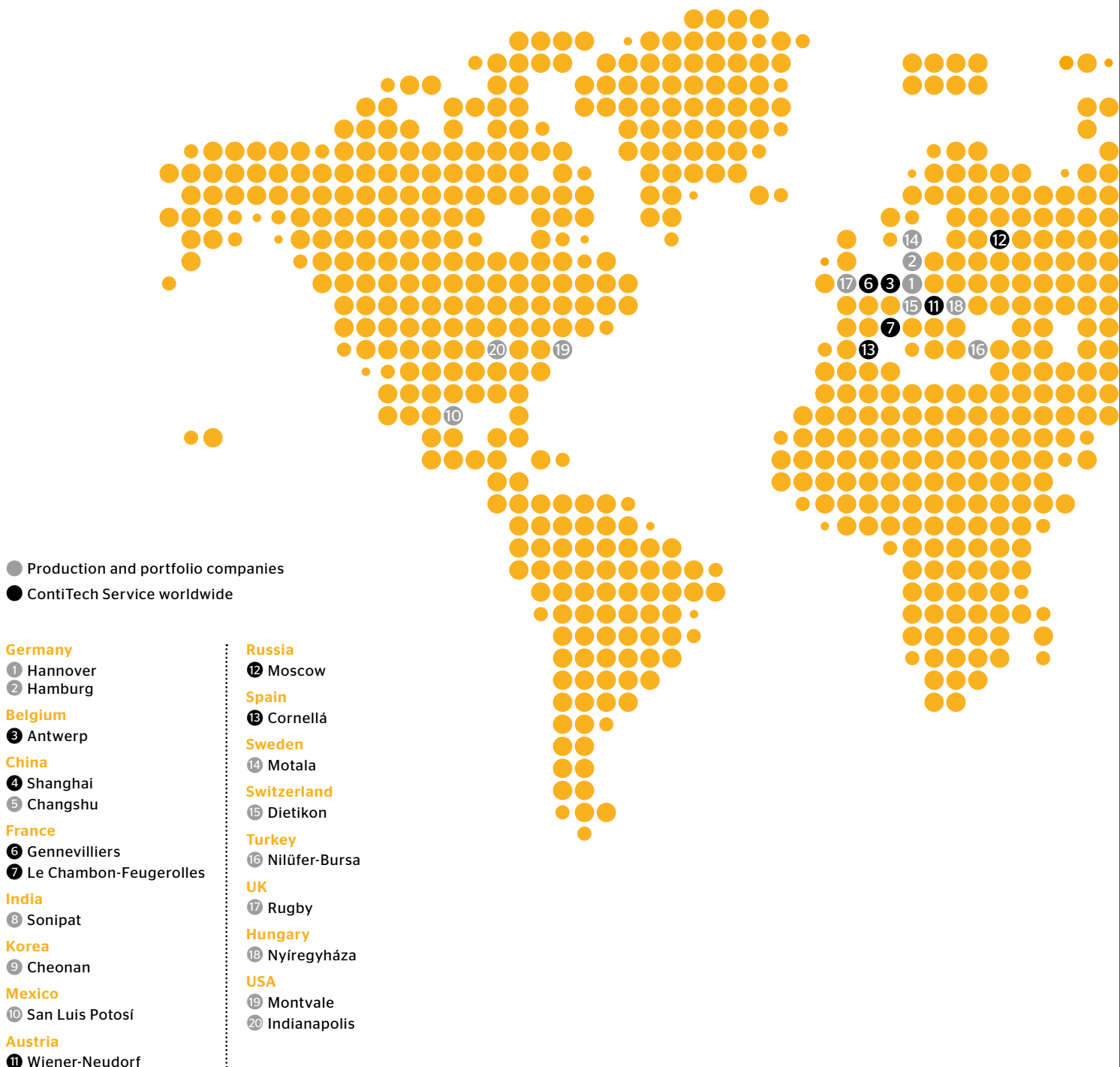
The multi-axial test bench can precisely control how air spring systems behave under the harshest conditions. Which forces impact on the system and how? How much deformation is there in the bellows? Whether it be horizontal and vertical or along the longitudinal axis, all stress scenarios are authentically simulated. We similarly measure the temperatures generated by frictional forces (picture), and assess the tolerance for spring movements in the bogie.



# ContiTech Railway Engineering

## Present worldwide

With our international production plants, partnerships and a worldwide sales network, we can guarantee rapid on-site presence – on virtually every continent. No service could be faster, more reliable or more customer-focused.



# < 300

**The staff** at ContiTech Railway Engineering develop and manufacture high-tech products and systems at locations in China, Germany, Korea, France, India and Hungary.

# 19

**locations**  
in 16 countries

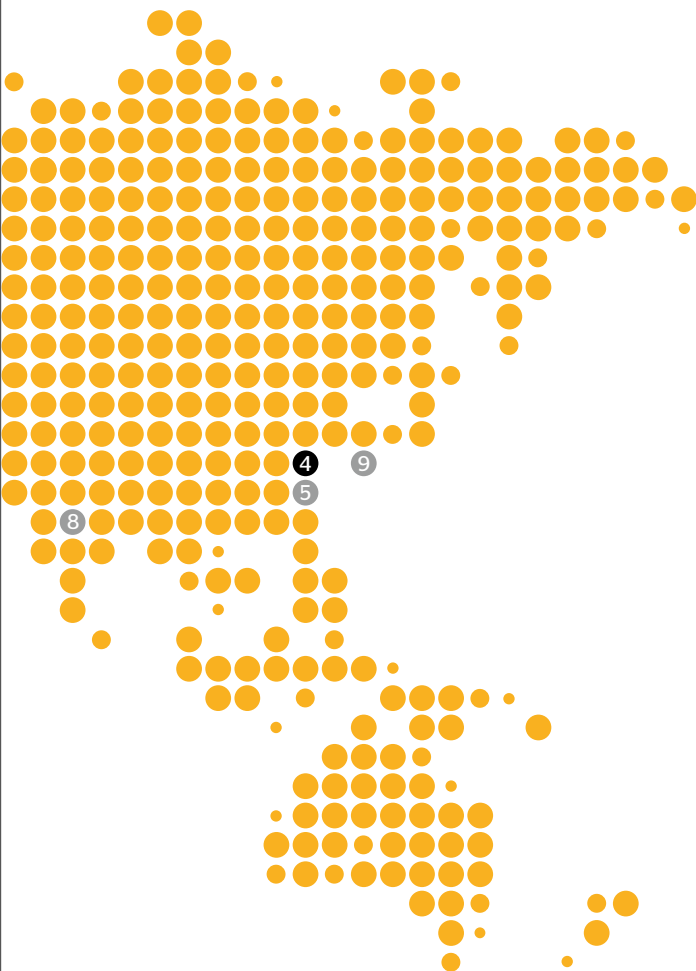
## Awards

**Shanghai, China:** ContiTech Air Spring System is one of the „50 most innovative companies at the Rail & Metro China“

**Nyíregyháza, Hungary:** Phoenix Air Spring Technology is named „Industrial company of the year“

## Our locations are certified in accordance with:

- > IRIS (International Railway Industry Standard)
- > Q1 - Deutsche Bahn licence
- > Accreditation under ISO/IEC 17025
- > All locations under ISO 9001
- > Certification under ISO 14001
- > Certification under ISO/TS 16949



# ContiTech



## Air Spring Systems

Market segment

**Railway Engineering**

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Learn more about  
the contents of this  
brochure.



## ContiTech. Engineering Next Level

As a division of the Continental Group, ContiTech is a recognised innovation and technology leader in natural rubber and plastics. As an industry partner with a firm future ahead of us, we engineer solutions both with and for our customers around the world. Our bespoke solutions are specially tailored to meet the needs of the market. With extensive expertise in materials and processes, we are able to develop cutting-edge technologies while ensuring we make responsible use of resources. We are quick to respond to important technological trends, such as function integration, lightweight engineering and the reduction of complexity, and offer a range of relevant products and services. That way, when you need us, you'll find we're already there.