



System DFF MC/CT

Highly elastic rail fastening for metro and tram –
the budget-oriented solution for slab track

Vossloh fastening systems

Based on our experience we are setting standards of the future.



Urban Transport – Always smooth with stop and go

Frequent starting and stoppings at many stops within the shortest time characterize urban transport. In this case, highly elastic components provide for comfortable travelling at high operating safety and reduced noise – at axle loads of up to 18 t (Metro) / 13 t (Tram).

Cost-efficiency and sustainability in urban transport

Due to the increasing number of local traffic projects in cities and conurbations, Vossloh has developed two cost-efficient elastic rail fastening systems: The DFF CT system is planned to be used in tram projects and the DFF MC is for metros. They can be mounted on plain sleepers and track plates without embedding the plastic baseplate in concrete, however they can also be used in connection with all usual solutions of slab track.

The new and efficient design of the tension clamp Skl MC ensures high resilience and safe restraint of the rail. Furthermore, the *cellentic* rail pad damps the vibrations and minimizes structure-borne track vibration: Adjacent building are protected from shocks. *cellentic* rail pad, angled guide plates and baseplate can be pre-assembled together already before final assembly.

This solution for preassembly allows fast installation and reduces the risk of installation errors in the track. The high portion of durable plastics ensures corrosion protection and electrical insulation. Compared to steel this light-weight material also provides logistic advantages and easier handling during installation.



Vossloh protect:

The new coating for tension clamps, sleeper screws and T-head bolts (incl. nuts and washers) – for a consistent and high coating quality.

Advantages

- Conventional barrier protection **plus** cathodic corrosion protection, preventing the base material from corroding in the event of damages, e.g. caused by flying ballast.
- Withstands extreme conditions such as high temperature fluctuations, high humidity and industrial climate (acid rains).



cellentic is an elastomer made of EPDM that ensures high stability against many types of chemical attacks. The advantage: the material provides excellent resistance to temperature, aging, and weather conditions as well as it is very stable under permanent load. *cellentic* components optimize the elasticity for a reduction of vibrations and the protection of track.

System DFF MC / CT

Elastic. Safe. Resilient. Flexible.

The innovative design of the tension clamp Skl MC provides safety and durability

For meeting the required *rail creep resistance* two highly elastic, independently acting spring arms steadily hold the rail down; the middle bend acts as an additional *tilting protection*. With its high fatigue strength, it resists the dynamic vertical movements that are caused when the vehicle passes over the rail. The system is *maintenance-free*: Due to the permanently acting tension, Skl and screw cannot loosen, the middle bend prevents the spring arms from plastic deformation.

Guide plates keep the rail in the track

The guide plates direct the forces introduced into the rail by train first into the baseplate and then into the concrete. In this way, the screw-dowel combinations are not loaded by shearing and bending forces. The design of the guide plates additionally supports the *tilting protection*. Different widths can *regulate the gauge*.

Adjustable height

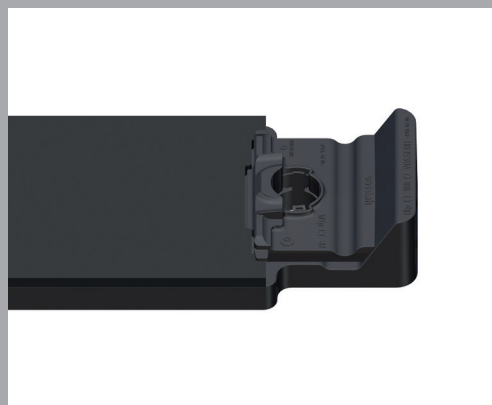
Using height adjustment plates, the *height of the system can be regulated within 30 mm*. With the optimized height adjustment plates *NG* the *cellentic* rail pad rests completely on the bearing face.

cellentic rail pad for high elasticity

The elasticity of the particular *cellentic* material ensures the compensation of vertical forces and with this, stable rail deflection; it also damps vibrations and *minimizes the structure-borne noise*.

Safely tied

By means of screw-dowel combinations, the tension clamps are fixed in the concrete plate of the track structure.



Easy handling for installation and rail maintenance due to preassembly and exchangeability

- Flexibly applicable as single support point: no special shoulders (e.g. for concrete sleepers) required.
- Installation is possible both with top-down and with bottom-up method.
- The single support point can be delivered as preassembled component: Baseplate, guide plates, and rail pad can be plugged together and with this, they form a preassembled component.
- For welding of the rail, no fastening elements have to be removed from the support point.
- All components can be replaced.

Safety. Comfort. Track protection.

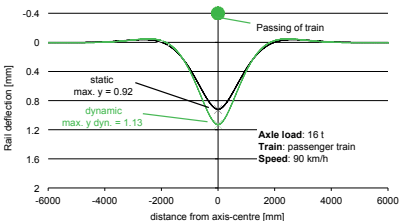
Travel comfort through optimum rail deflection

The railway track must be elastic to compensate forces caused by running trains. Because ballast is not used for slab tracks, these highly elastic *cellentic* components of the rail fastening system are designed to undertake this job. The DFF MC with *cellentic* rail pad allows rail deflection and can optimally distribute occurring vertical forces. The result: Protection of track. Its elasticity is adapted to the traffic load to achieve optimum rail deflection: load distribution is at the maximum without overloading the rail. Furthermore, the *cellentic* component damps the vibrations caused by the unevenness of the track and the wheels; structure-borne track vibration is minimized. The result: high travel comfort, high safety through smooth running, as well as long lifetime of track components and vehicles.

Creep resistance and rail tilting protection

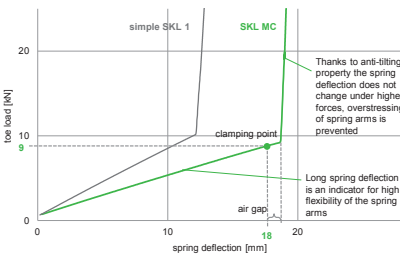
To allow optimum deflection for the rail, its fastening must respond in an elastic way. Therefore, the Skl MC has a long spring deflection: When force is applied by a train, its spring arms remain in contact with the rail foot in each situation, also when the rail deflects. For this purpose, the rail is continuously clamped in a force-fitted way by the two spring arms with a spring deflection of approx. 18 mm and a toe load of approx. 9 kN. With this, also a high creep resistance is achieved: When the trains accelerate/decelerate, the rails remain in position, dangerous open fracture gaps due to broken rails are avoided. Simultaneously, a small gap between the middle bend and the rail foot of the rail has exactly the play required for operation. If the rail tilts excessively, e.g. in narrow curves, high forces are applied to the tension clamp. The Skl MC is able to resist them: Rail movements are limited by the middle bend after the gap has been overcome, and the spring arms are not overstretched.

Zimmermann computation



Simplified demonstration: one axle of a two axle bogie

Load-deflection-curve



Rail fastening system DFF MC/ CT with tension clamp Skl MC		
Typical field of application	Urban transport/Transit; slab track, grooveless sleepers	
Axle load	≤ 18 t	
Speed	≤ 140 km/h	
Curve radius	≥ 80 m	
Height adjustment	+ 30 mm	
Gauge adjustment	± 12 mm	
Vertical fatigue strength of Skl MC	3.0 mm	
Static stiffness of <i>cellentic</i> rail pad	≥ 30 kN/mm	EN 13146-9:2011
Relation of dyn./stat. stiffness of <i>cellentic</i> rail pad	1.1	EN 13146-9:2011
Toe load of Skl MC (nominal)	9 kN	EN 13146-7: 2012
Electrical resistance	≥ 10 kΩ	EN 13146-5: 2003
Rail creep resistance	≥ 9 kN	EN 13146-1: 2012
Corrosion protection category (Skl)	C5-L (1440 h stainless)	ISO 12944
System audit/homologation		EN 13481-5: 2012

Remark: Contents, figures and technical data in this brochure display the performance of the fastening system, however, they always depend on external conditions. Please contact us to enable us to develop a solution for you that will be customized to your requirements. The information presented corresponds to the technical state at the time of printing; in the meantime, continuous research and development programmes at Vossloh could have caused adaptations of the product.